Vol. I

TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1938

No. 441

THE ELECTRIC STORAGE BATTERY CO.,
PETITIONER,

vs.

GENZO SHIMADZU AND NORTHEASTERN ENGINEERING CORPORATION

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT

PETITION FOR CERTIORARI FILED OCTOBER 27, 1938.

CERTIORARI GRANTED DECEMBER 5, 1938.

INDEX.

	Page
Docket Entries	1
Bill of Complaint	7
Answer of The Electric Storage Battery Company	28
Notice of Motion for Leave to Amend Answer	43
Amended Answer	43
Notice of Motion	44
Motion for Leave to Inspect Defendant's Plant	45
Affidavit of James T. Newton	48
Affidavit of Luyho S. Ishimura	50
Answer to Motion and Affidavits	56
Affidavit of John H. Williams	67
Affidavit of Edward Wanton Smith	70
Affidavit of Clarence A. Hall	72
Affidavit of Joseph Lester Woodbridge	74
Affidavit of C. Reed Cary	78
Affidavit of Edward W. Smith	80
Defendant's Memorandum in Opposition to Plaintiffs' Motion to Inspect Defendant's Plant	80
Defendant's Supplemental Memorandum in Reply to Plaintiffs' Memorandum and Supplemental Memorandum in Support of Plaintiffs' Motion for Inspection	94
Notice of Defendant's Motion for Bill of Particulars	108
Defendant's Motion for Bill of Particulars	109

	Page
Notice of Motion for Leave to file Interrogatories	110
Defendant's Motion for Leave to file Interrogatories after Expiration of Twenty-one Days	111
Interrogatories Propounded by Defendant	112
Interrogatories Propounded by Plaintiffs, Pursuant to Equity Rule 58	113
Motion for Further and Better Particulars of Defenses	115
Defendant's Bill of Particulars	118
Answers of R. C. Norberg to Interrogatories	122
Answers of Northeastern Engineering Corporation and Genzo Shimadzu	123
Plaintiffs' Bill of Particulars	134
Order for Letters Rogatory	136
Order of Amendment	137
Narrative Statement of Evidence	138

PLAINTIFFS' EVIDENCE:

	Direct	Cross	Re-D.	Re-C.
L. S. Ishimura	139	173	185	186
			190	191
			192	192
			196	
George L. Clark	197	276	381	586
			676	686
			688	
George Lane Kyle	383	393	400	400
			401	
William Cooper	401	410	419	423

DEFENDANT'S EVIDENCE:

Edward W. Smith	428	479	516	523
			555	556
Jacob Hoelzle	526	527		

	Direct	Cross	Re-D.	Page Re-C.
Benjamin Shablin...	527	530	530	
George M. Howard...	531			
William E. Kershaw.	532	549	555	
			579	582
			585	
William H. Reinhardt	556	570	572	575
			576	576
			578	578
Richard S. Garton...	688	690		
J. Lester Woodbridge	690	719	724	
Wheeler P. Davey...	727	797	851	
			882	888
			890	895
Harold V. Anderson.	854	876	880	881
			1018	
Warren W. Ewing..	896	940		
Harry W. Ullmann..	959	997		
Clarence A. Hall....	1020	1024		
		1038	1047	
Edward Clocker....	1035	1035		

PLAINTIFFS' EVIDENCE IN REBUTTAL:

George L. Clark...	1051	1092	1125	1128

RETURN OF LETTERS ROGATORY.

	Direct	Cross	Re-D.	Re-C.
Genzo Shimadzu....	1130	1149		
Suveharu Uchiyama..	1153			
Tominosuke Hichijo.	1157			

Stipulation 1159

Order 1161

Opinion, Kirkpatrick, J. 1162

Memorandum Amending Opinion after Rehearing, Kirkpatrick, J. 1189

Decree 1192

	Page
Petition for Appeal	1196
Order Allowing Appeal	1197
Assignments of Error	1198
Citation	1205
Petition for Cross-Appeal by Plaintiffs	1206
Order Allowing Appeal	1207
Plaintiffs' Assignments of Error on Cross-Appeal	1208
Citation	1212
Praecipe for Transcript of Record	1213
Physical Exhibits	1216
Clerk's Certificate	1219
Order Assigning Hon. Oliver B. Dickinson for Argument	1221
Reference to Argument	1222
Opinion	1223
Order Affirming Decree	1226
Petition of Defendant-Appellant for Rehearing and Supporting Brief	1227
Order Denying Petition for Rehearing	1255
Clerk's Certificate	1256
Order allowing certiorari	1256

IN THE

District Court of the United States

FOR THE EASTERN DISTRICT OF PENNSYLVANIA.

No. 7727 March Term 1933.

Rawle & Henderson, Esqs. for Genzo Shimadzu and Northeastern Engineering Corporation. Hunt, Hill & Betts, Esqs. Edmund B. Whitcomb, Esq. George H. Souther, Esq.	GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION	
	vs.	
H. M. Morris, Esq. A. B. Stoughton, Esq. E. S. W. Farnum, Jr., Esq. for The Electric Storage Battery Co.	THE ELECTRIC STORAGE BATTERY CO.	

DOCKET ENTRIES.

1933

June 1 Bill of Complaint; filed.

1 Subpoena exit—returnable June 21, 1933.

3 Copy of Certificate forwarded to Commissioner of Patents, filed.

5 Subpoena returned on June 1, served and filed.

12 Printed copy of bill of complaint, filed.

12 Appearance of H. M. Morris, Esq., A. B. Stoughton, Esq., and E. S. W. Farnum, Jr., Esq., for defendant, filed.

23 Stipulation of counsel extending time in which to file answer, filed.

Aug.	9	Stipulation of counsel further extending time in which to file answer, filed.
Sept.	16	Stipulation of counsel extending time in which to file answer, filed.
	27	Bond for costs by Northeastern Engineering Corporation, with surety, in $250. and Decree approving bond, filed.
Oct.	13	Stipulation of counsel extending time in which to file answer, filed.
	30	Answer filed.
Nov.	11	Stipulation of counsel extending plaintiff's time in which to file and serve interrogatories, filed.
	28	Printed copy of answer, filed.
Dec.	19	Affidavit by L. S. Ishimura, filed.
	19	Notice of presenting motion and Motion by plaintiff for leave to inspect defendants plant, filed.
	19	Defendants answer to Motion, filed.
	19	Stipulation of counsel extending time in which to file interrogatories, filed.
	19	Argued sur motion for leave to inspect defendant's plant.
	20	Affidavit by Edward W. Smith, filed.
1934		
Jan.	5	Testimony filed.
	22	Stipulation of counsel extending time of plaintiffs in which to file and serve interrogatories, etc., filed.
	30	Printed copy of defendants answer and argument in opposition to motion for inspection, filed.
Feb.	5	Opinion, Kirkpatrick, J., granting leave to enter decree granting lease to inspect plant of defendant company, filed.

Apr.	17	Decree appointing J. Hunt Wilson as expert for purpose of inspecting defendants plants and reporting to the Court, filed.
	24	Stipulation of counsel extending time in which to take depositions, etc., and Decree approving stipulation, filed.
July	6	Application by plaintiffs for order to obtain additional samples and notice of presentation of application, filed.
	6	Decree denying application for order to obtain additional samples without prejudice, filed.
1935		
Jan.	17	Plaintiffs' objections to defendant's proposed inter partes tests at Toronto, Canada, and acknowledgement of receipt of copy thereof by counsel for defendant, filed.
May	28	Stipulation of counsel extending time for taking depositions etc., and Order of Court approving same, filed.
June	8	Notice of motion for leave to amend answer, filed.
	8	Notice of Defendant's motion for bill of particulars and motion for bill of particulars, filed.
	8	Notice of motion, motion for leave to file interrogatories, and interrogatories propounded by defendant, filed.
	22	Plaintiffs interrogatories to defendant, filed.
July	9	Decree directing Letters Rogatory to issue to Kyoto, Japan, filed.
	9	Plaintiffs motion for better particulars of defense filed.

Aug.	7	Interrogatories, filed.
	29	Defendants Bill of Particulars, filed.
	29	Answer by R. C. Norberg to interrogatories filed.
	29	Cross Interrogatories to G. Shimadzu, filed.
Sept.	19	Answers of Northeastern Engineering Corp. & G. Shimadzu to interrogatories, filed.
	19	Plaintiffs' bill of particulars, filed.
	23	Decree amending decree of July 3, 1935, providing for issuance of Letters Rogatory to Japan, filed.
	23	Letters Rogatory to Kyoto Japan, exit.
	25	Argued sur Pleading & proofs. Amended answer to plaintiffs interrogatory 6, filed.
	26	Hearing continued
Sept.	27	Hearing continued.
	30	Hearing continued.
Oct.	1	Hearing continued
	2	Hearing continued
	3	Hearing continued
	4	Hearing continued
	7	Hearing continued
	8	Hearing continued
	9	Hearing continued.
	10	Hearing concluded.

1936

Jan.	27	Stipulation of counsel extending time for filing defendant's brief, filed.
Feb.	17	Testimony (12 vol.) filed.
Mar.	14	Letters Rogatory from Japan received opened and filed.
	26	Stipulation of counsel extending time to and including April 16, 1936 in which to file reply brief, filed.

Apr. 16 Stipulation of counsel extending time to and including April 30, 1936, in which to file reply brief, filed.
July 14 Argued sur pleadings and proofs.
Oct. 6 Opinion, Kirkpatrick, J., sur pleadings and proofs filed.
Nov. 20 Memorandum amending opinion (Kirkpatrick, J.) filed.
Dec. 14 Final decree in favor of plaintiffs with costs, filed.
14 Petition for Appeal, filed.
14 Order of Court allowing appeal, filed.
14 Assignments of Error, filed.
14 Bond sur appeal in $50,000. with U. S. Guarantee Co., Surety, and Order of Court approving bond, filed.
14 Citation allowed and issued.
14 Copy of notice of appeal, filed.
19 Citation returned: "service accepted" and filed.
23 Certificate of termination of suit transmitted to Comm'r. of Patents and copy filed.

1937

Jan. 11 Order of Court extending time for perfecting appeal, filed.
12 Petition for Cross-Appeal by plaintiffs, filed.
12 Order of Court allowing appeal, filed.
12 Plaintiffs assignments of error, filed.
12 Bond sur appeal in $250. with Aetna Casualty & Surety Co., surety and Order of Court approving bond, filed.
12 Citation allowed and issued.
12 Copy of service of Appeal, filed.

13 Citation returned "Service accepted" and filed.

Feb. 10 Order of Court extending defendants time for filing record on appeal, filed.

Mar. 13 Order of Court extending time for perfecting appeals, filed.

Apr. 19 Stipulation of counsel and Order of Court approving narrative statement of evidence etc., filed. (3 vol.)

May 1 Order of Court extending defendants time for filing record on appeal filed.

" 1 Certified copy of Order of U. S. Circuit Court of Appeals granting leave to defendant to apply to this Court to take additional testimony filed.

" 10 Petition of defendant to vacate interlocutory decree and to reopen case filed.

" 28 Answer of plaintiffs to petition for rehearing filed.

June 10 Printed copy of Petition to reopen case filed.

July 3 Praecipe for transcript of record sur appeal filed.

" 7 Order of Court extending time for filing record on appeal filed.

Sept. 14 Opinion, Kirkpatrick, J., denying petition of defendant to take new evidence etc., filed.

Oct. 4, Decree dismissing petition of defendant to take new evidence etc., with costs, filed.

IN THE
DISTRICT COURT OF THE UNITED STATES
FOR THE EASTERN DISTRICT OF PENNSYLVANIA.

IN EQUITY NO. 7727.

March Term, 1933.

GENZO SHIMADZU AND NORTHEASTERN ENGINEERING CORPORATION,
Plaintiffs.

v.

THE ELECTRIC STORAGE BATTERY CO.,
Defendant.

BILL OF COMPLAINT.

(Filed June 1, 1933.)

To the Honorable the Judges of the United States District Court for the Eastern District of Pennsylvania:

Now come the plaintiffs above named and for their Bill of Complaint respectfully allege as follows on information and belief:

1. Plaintiff, Genzo Shimadzu, is a subject of the Empire of Japan and a resident of the City of Kyoto, Empire of Japan.

2. Plaintiff, Northeastern Engineering Corporation, is a corporation organized and existing under and by virtue of the laws of the State of Delaware,

a citizen of Delaware, having its principal place of business at Wilmington, and a resident of Wilmington, in the County of Newcastle, State of Delaware.

3. Defendant, The Electric Storage Battery Company, is and was at the times hereinafter mentioned, a corporation organized and existing under and by virtue of the laws of the State of New Jersey, a citizen of New Jersey, and a resident and having its principal, regular and established places of business within this district at Allegheny Avenue and Nineteenth Street, at No. 1935 Hunting Park Avenue, and at Rising Sun Avenue and Asylum Park, City of Philadelphia, County of Philadelphia, State of Pennsylvania, within which District it has committed and now is committing acts of infringement of which complaint is made herein.

4. This is a suit in Equity under the Patent Laws of the United States.

5. Before July 14, 1923, plaintiff, Genzo Shimadzu, was the true, original, first and sole inventor or discoverer of a certain new and useful Process of Manufacturing Powder of Lead Suboxide Intermingled with Powder of Metallic Lead and the product thereof not known or used by others in this country prior to his invention or discovery thereof, nor patented nor described in any printed publication in this or any foreign country prior to his invention or discovery, nor more than two years prior to said July 14, 1923, and not in public use or on sale in this country more than two years prior to said July 14, 1923, and not first patented in any foreign country by him or his representatives or assigns on an

application filed more than twelve months prior to said July 14, 1923, and not abandoned.

6. On said July 14, 1923, said Genzo Shimadzu did make application in writing to the Commissioner of Patents of the United States, Serial No. 657,621, for Letters Patent for his said invention or discovery in Process of Manufacturing Powder of Lead Sub oxide Intermingled with Powder of Metallic Lead and the product thereof according to the form of the statute in such cases made and provided; and after due and lawful proceedings had and due examination made by the Commissioner of Patents, Letters Patent of the United States No. 1,584,150 were on the eleventh day of May, 1926, granted unto plaintiff, Genzo Shimadzu, his heirs and assigns, as the result of said application and were signed by the proper officers of the United States Patent Office, and sealed with the seal of the United States Patent Office, and duly recorded in the United States Patent Office in books kept for the purpose, whereby there was granted to said Genza Shimadzu, his heirs and assigns, for the term of seventeen years next succeeding the said eleventh day of May 1926, the exclusive right to make, use and vend the said invention throughout the United States and territories thereof, a complete description of which invention was contained in the specifications of which a copy was attached to and made a part of said Letters Patent. The original or a certified copy of said Letters Patent is here in court ready to be produced.

7. Before January 30, 1922, plaintiff Genzo Shimadzu, was the true, original, first and sole inventor or discoverer of a certain new and useful Method of

Manufacturing Metal Powder not known or used by others in this country prior to his invention or discovery thereof, nor patented nor described in any printed publication in this or any foreign country prior to his invention or discovery, nor more than two years prior to said January 30, 1922, and not in public use or on sale in this country more than two years prior to said January 30, 1922, and not first patented in any foreign country by him or his representatives or assigns on an application filed more than twelve months prior to said January 30, 1922, and not abandoned.

8. On said January 30, 1922, said Genzo Shimadzu did make application in writing to the Commissioner of Patents of the United States, Serial No. 532,920, for Letters Patent for his said invention or discovery in Method of Manufacturing Metal Powder according to the form of the statue in such cases mde and provided; and after due and lawful proceedings had and due examination made, by the Commissioner of Patents, Letters Patent of the United States No. 1,584,149 were on the eleventh day of May, 1926, granted unto plaintiff, Genzo Shimadzu, his heirs and assigns, as the result of said application and were signed by the proper officers of the United States Patent Office and sealed with the seal of the United States Patent Office, and duly recorded in the United States Patent Office in books kept for the purpose, whereby there was granted to said Genzo Shimadzu, his heirs and assigns, for the term of seventeen years next succeeding the eleventh day of May, 1926, the exclusive right to make, use and vend the said invention throughout the United States and territories thereof, a complete description of which invention was contained in the specifications of which a copy was

attached to and made a part of said Letters Patent. The original or a certified copy of said Letters Patent is here in court ready to be produced.

9. Before April 18, 1924, plaintiff, Genzo Shimadzu, was the true, original, first and sole inventor or discoverer of a certain new and useful Process of Manufacturing Lead Oxide not known or used by others in this country prior to his invention or discovery thereof, nor patented nor described in any printed publication in this or any foreign country prior to his invention or discovery, nor more than two years prior to said April 18, 1924, and not in public use or on sale in this country more than two years prior to said April 18, 1924, and not first patented in any foreign country by him or his representatives or assigns on an application filed more than twelve months prior to said April 18, 1924, and not abandoned.

10. On said April 18, 1924, said Genzo Shimadzu did make application in writing to the Commissioner of Patents of the United States, Serial No. 707,509, for Letters Patent for his said invention or discovery in Process of Manufacturing Lead Oxide according to the form of the statute in such cases made and provided; and after due and lawful proceedings had and due examination made by the Commissioner of Patents, Letters Patent of the United States No. 1,584,151 were on the eleventh day of May, 1926, granted unto plaintiff, Genzo Shimadzu, his heirs and assigns, as the result of said application and were signed by the proper officers of the United States Patent Office and sealed with the seal of the United States Patent Office, and duly recorded in the United States Patent Office in books kept for the purpose, whereby there was

granted to said Genzo Shimadzu, his heirs and assigns, for the term of seventeen years succeeding the said eleventh day of May, 1926, the exclusive right to make, use and vend the said invention throughout the United States and territories thereof, a complete description of which invention was contained in the specifications of which a copy was attached to and made a part of said Letters Patent. The original or a certified copy of said Letters Patent is here in court ready to be produced.

11. Before April 18, 1924, plaintiff, Genzo Shimadzu, was the true, original, first and sole inventor or discoverer of a certain new and useful Paint not not known or used by others in this country prior to his invention or discovery thereof, nor patented nor described in any printed publication in this or any foreign country prior to his invention or discovery, nor more than two years prior to said April 18, 1924, and not in public use or on sale in this country more than two years prior to said April 18, 1924, and not first patented in any foreign country by him or his representatives or assigns on an application filed more than twelve months prior to said April 18, 1924, and not abandoned.

12. On said April 18, 1924, said Genzo Shimadzu did make application in writing to the Commissioner of Patents of the United States, Serial No. 707,510, for Letters Patent for his said invention or discovery in Paint according to the form of the statutee in such cases made and provided; and after due and lawful proceedings had and due examination made by the Commissioner of Patents, Letters Patent of the United States No. 1,584,152, were on the eleventh day of May, 1926, granted unto plaintiff, Genzo Shi-

madzu, his heirs and assigns, as the result of said application and were signed by the proper officers of the United States Patent Office and sealed with the seal of the United States Patent Office, and duly recorded in the United States Patent Office in books kept for the purpose, whereby there was granted to said Genzo Shimadzu, his heirs and assigns, for the term of seventeen years next succeeding the said eleventh day of May, 1926, the exclusive right to make, use and vend the said invention throughout the United States and territories thereof, a complete description of which invention was contained in the specifications of which a copy was attached to and made a part of said Letters Patent. The original or a certified copy of said Letters Patent is here in court ready to be produced.

13. Before February 20, 1923, plaintiff, Genzo Shimadzu, was the true, original, first and sole inventor or discoverer of a certain new and useful Process of Making Plates for Storage Batteries Using Lead Suboxide not known or used by others in this country prior to his invention or discovery thereof, nor patented nor described in any printed publication in this or any foreign country prior to his invention or discovery, nor more than two years prior to said February 20, 1923, and not in public use or on sale in this country more than two years prior to said February 20, 1923, and not first patented in any foreign country by him or his representatives or assigns on an application filed more than twelve months prior to said February 20, 1923, and not abandoned.

14. On said February 20, 1923, said Genzo Shimadzu did make application in writing to the Commissioner of Patents of the United States, Serial No.

620,267, for Letters Patent for his said invention or discovery in Process of Making Plates for Storage Batteries Using Lead Suboxide according to the form of the statute in such cases made and provided; and after due and lawful proceedings had and due examination made by the Commissioner of Patents, Letters Patent of the United States No. 1,584,479 were on the eleventh day of May, 1926, granted unto plaintiff, Genzo Shimadzu, his heirs and assigns, as the result of said application and were signed by the proper officers of the United States Patent Office and sealed with the seal of the United States Patent Office, and duly recorded in the United States Patent Office in books kept for the purpose, whereby there was granted to said Genzo Shimadzu, his heirs and assigns, for the term of seventeen years next succeeding the said eleventh day of May, 1926, the exclusive right to make, use and vend the said invention throughout the United States and territories thereof, a complete description of which invention was contained in the specifications of which a copy was attached to and made a part of said Letters Patent. The original or a certified copy of said Letters Patent is here in Court ready to be produced.

15. Before April 27, 1926, plaintiff, Genzo Shimadzu, was the true, original, first and sole inventor or discoverer of a certain new and useful Apparatus for the Continuous Production of Lead Oxides in the Dry State, not known or used by others in this country prior to his invention or discovery thereof, nor patented nor described in any printed publication in this or any foreign country prior to his invention or discovery, nor more than two years prior to said April 27, 1926, and not in public use or on sale in this country more than two years prior to said April 27,

1926, and not first patented in any foreign country by him or his representatives or assigns on an application filed more than twelve months prior to said April 27, 1923, and not abandoned.

16. On said April 27, 1926, said Genzo Shimadzu did make application in writing to the Commissioner of Patents of the United States, Serial No. 104,999, for Letters Patent for his said invention or discovery in Apparatus for the Continuous Production of Lead Oxides in the Dry State according to the form of the statute in such cases made and provided, which said application was subsequently renewed on June 21, 1929; and after due and lawful proceedings had and due examination made by the Commissioner of Patents, Letters Patent of the United States No. 1,896,020 were on the thirty-first day of January, 1933, granted unto plaintiff, Genzo Shimadzu, his heirs and assigns, as the result of said application and were signed by the proper officers of the United States Patent Office and sealed with the seal of the United States Patent Office, and duly recorded in the United States Patent Office in books kept for the purpose, whereby there was granted to said Genzo Shimadzu, his heirs and assigns, for the term of seventeen years next succeeding the said January 31, 1933, the exclusive right to make, use and vend the said invention throughout the United States and territories thereof, a complete description of which invention was contained in the specifications of which a copy was attached to and made a part of said Letters Patent. The original or a certified copy of said Letters Patent is here in Court ready to be produced.

17. By an instrument in writing, signed, sealed and delivered in due from of law on the fourteenth

day of February, 1933, said plaintiff Genzo Shimadzu gave and granted unto plaintiff, Northeastern Engineering Corporation, an exclusive license for the whole of the United States, its territories and possessions, to employ the process described and claimed in said Letters Patent of the United States in suit, No. 1,584,150, No. 1,584,149, No. 1,584,151, No. 1,584,152, No. 1,584,479 and No. 1,896,020, and to manufacture, use and sell the product made according to and embodying the inventions described and claimed in said Letters Patent of the United States No. 1,584,150, No. 1,584,149, No. 1,584,151, No. 1,584,152, No. 1,584,479 and No. 1,896,020, together with the right to license others to employ the process described and claimed in, and to manufacture, use and sell product made according to and embodying the inventions of said Letters Patent in suit No. 1,584,150, No. 1,584,149, No. 1,584,151, No. 1,584,152, No. 1,584,479 and No. 1,896,020.

Profert of said exclusive license or a duly authenticated copy thereof is hereby made.

18. Since the granting of said Letters Patent of the United States in suit, No. 1,584,150, No. 1,584,149, No. 1,584,151, No. 1,584,152, No. 1,584,479 and No. 1,896,020, the plaintiff, Genzo Shimadzu, has been and now is vested with legal title in and to the same and that since the said grant and transfer to plaintiff, Northeastern Engineering Corporation, of said exclusive license thereunder, it has been and now is vested with an exclusive license to employ the process described and claimed in, and to manufacture, use and sell the product made according to and embodying the inventions described and claimed in said Letters Patent of the United States in suit, No. 1,584,150, No. 1,584,149, No. 1,584,151, No. 1,584,152, No. 1,584,479

and No. 1,896,020, with the right to grant licenses to others to employ the process described and claimed in, and to manufacture, use and sell the product made according to and embodying the inventions of said Letters Patent in suit, No. 1,584,150, No. 1,584,149, No. 1,584,151, No. 1,584,152, No. 1,584,479 and No. 1,896,020.

19. Under each of the aforesaid Letters Patent licenses to practice the processes and/or methods disclosed and/or claimed therein and licenses to make, use and/or sell the products disclosed and/or claimed therein have been granted to the following corporations:

1. Northeastern Engineering Corporation, a a corporation organized and existing under and by virtue of the laws of the State of Delaware, having its principal place of business in Wilmington, Delaware.

2. U S L Battery Corporation, a corporation organized and existing under and by virtue of the laws of the State of New York, having its principal place of business at Niagara Falls, New York.

3. Prest-O-Lite Storage Battery Corporation, a corporation organized and existing under and by virtue of the laws of the State of Indiana, having its principal place of business at Speedway, Indianapolis, Indiana.

4. Southwest Battery Corporation, a corporation organized and existing under and by virtue of the laws of the State of Delaware, having its principal place of business in Oklahoma City, Oklahoma.

5. U S L Battery Corporation of California, a corporation organized and existing under and by virtue of the laws of the State of California, having its principal place of business at Oakland, California.

6. Wubco Battery Corporation, a corporation organized and existing under and by virtue of the laws of the State of New York having its principal place of business at Niagara Falls, New York.

7. Marko Storage Battery Corporation, a corporation organized and existing under and by virtue of the laws of the State of New York, having its principal place of business in Brooklyn, New York.

20. Before the dates of issuance of the five first mentioned of the foregoing Letters Patents the defendant by and through its agents sought out the plaintiff in Japan and represented that it was interested in his inventions above described, and thereupon requested and was granted by plaintiff Shimadzu and had full access to the manufacturing plant in Japan operating the processes and producing the products embodying his inventions above described, and was given disclosure of all necessary mechanical and chemical details relating to the said processes and products forming the basis of the patent hereinbefore set forth. Defendant thereafter requested the plaintiff Shimadzu to proceed or send a representative to Philadelphia in this District to negotiate with the defendant to further explain and disclose the processes and products covered by the aforementioned patents and particularly the details of the practical commercial operation thereof.

In pursuance thereof one Lyuho S. Ishimura, agent of and representing plaintiff Shimadzu, proceeded to Philadelphia in the year 1926 at the request of defendant and at its request continued to furnish defendant with further data and information covering the practical operation and cost of commercializing the processes and products claimed and set forth in said Letters Patent, the defendant still representing that it was interested in acquiring rights in said inventions.

21. Defendant obtained from said Shimadzu the explanations, information, data and disclosures aforesaid concerning said inventions not for the purpose of acquiring the patents therefor or a license thereunder, but for the purpose of ascertaining and using in its own business the processes and making, using and selling the products covered by the said patents, without compensating said plaintiff Shimadzu, and willfully and fraudulently intending to infringe said patents.

22. In the meantime one Clarence Hall, an employee of the defendant company, had pending in the United States Patent Office an application for making certain lead products and the processes relating thereto, Serial Number 702,889, filed March 29, 1924, allowed February 6, 1926, and which application became forfeited on the sixth day of August, 1926. Thereafter said Hall's application was renewed by or through the action of the defendant on the twenty-fourth day of December, 1926, at which time claims verbatim with the Shimadzu patent aforesaid, No. 1,584,150, were inserted in said Hall application and a new application filed, Serial Number 156,980, containing verbatim certain claims of the plaintiff Shi-

madzu patent No. 1,584,152; whereupon negotiations with said Shimadzu and his representatives were terminated by defendant and two interferences, Numbers 54,798 and 56,224, were declared by the United States Patent Office between said Hall applications and Shimadzu Patents Nos. 1,584,150 and 1,584,152.

23. Testimony was taken by both parties to said interference, the result being a holding in favor of priority of invention for Shimadzu by the Examiner of Interferences in the United States Patent Office August 29, 1929; a decision favorable to Shimadzu before the Board of Appeals in the United States Patent Office November 26, 1930, and a decision on June 20, 1932, in favor of Shimadzu by the Court of Customs and Patent Appeals, Washington, D. C., all of which proceedings were conducted on behalf of said Hall by and on the authority of the defendant.

24. Plaintiff therefore avers that defendant, appropriating and utilizing the aforesaid information and data, and utilizing the aforesaid disclosures of the aforesaid Shimadzu inventions and patents, has willfully and fraudulently infringed the aforesaid patents as hereafter more particularly set forth.

25. That the defendant, The Electric Storage Battery Company, without the license or authority of plaintiffs, and well knowing the premises and the rights secured to the plaintiffs under the said Letters Patent of the United States in suit and each of them but contriving to injure plaintiffs and to deprive them of profits and advantages which otherwise would accrue to them from said inventions, after the granting of said Letters Patent of the United States in suit and each of them as aforesaid, and before the

commencement of this suit and within six years next prior to the filing of this bill of complaint, within this Eastern District of Pennsylvania and elsewhere in the United States, did willfully, fraudulently and unlawfully make, use and sell, and is now making, using and selling and is threatening to continue to make, use and sell the products made in accordance with and embodying the inventions described in and covered by the said Letters Patent of the United States in suit, No. 1,584,150, No. 1,584,149, No. 1,584,151, No. 1,584,152, No. 1,584,479 and No. 1,896,020, and each of them; and before commencement of this suit and within six years next prior to the filing of this Bill of Complainant did willfully, fraudulently and unlawfully practice and is now willfully and unlawfully practicing and is threatening to continue to willfully and unlawfully practice within this Eastern District of Pennsylvania and elsewhere in the United States the processes described in and embodying the inventions embraced, covered and described by said Letters Patent of the United States in suit, No. 1,584,150, No. 1,584,149, No. 1,584,151, No. 1,584,152, No. 1,584,479, No. 1,896,020, and each of them; and willfully and fraudulently did infringe, is infringing and threatening to infringe each of the aforesaid patents within this District and elsewhere in the United States.

26. Defendant was duly notified of its said infringement upon said Letters Patent of the United States in suit.

27. The said defendant has derived and received, and will derive and receive from the aforesaid infringement, gains, profits and advantages, but to what amount the plaintiffs are not informed and can-

not set forth; and the plaintiffs by reason of the aforesaid infringement have been and will be deprived and prevented from receiving, if such infringement is not restrained by this Court, all the gains and profits to which the plaintiffs are lawfully entitled and which they would have derived and received and would now be deriving and receiving but for the aforesaid infringement. By reason of the aforesaid infringement the plaintiffs have been irreparably injured and have sustained great loss and damage thereby; and unless said infringement is enjoined and restrained by an order and writ of injunction issuing out of this Honorable Court, further irreparable injury, loss and damage will be caused to the plaintiffs. Plaintiffs have no adequate remedy at law.

Plaintiffs therefore pray:

(a) That defendant be required to answer this Bill of Complaint, but not under oath, answer under oath being hereby expressly waived.

(b) That this Court decree that plaintiffs' aforesaid Letters Patent of the United States No. 1,584,150, No. 1,584,149, No. 1,584,151, No. 1,584,152, No. 1,584,479 and No. 1,896,020 are good and valid and are owned by the plaintiffs and have been and are being infringed by the defendant.

(c) That this Honorable Court grant a preliminary injunction pending this suit, and a perpetual injunction restraining and enjoining defendant, its officers, agents, employees, associates and confederates, from making and/or using and/or vending the product, and practicing the processes, embodying the patented inventions claimed in the aforesaid Letters Patent and each of them, and from offering or advertising so to do and from aiding or abetting in any

way or in any way contributing to the infringement of said Letters Patent and each of them.

(d) That the defendant be ordered and decreed to deliver to the plaintiffs all infringing apparatus which it has in its possession and/or under its control and/or that such apparatus be destroyed and/or that the same be delivered to this Honorable Court and/or be impounded as to the Court may seem just and proper.

(e) That this cause be referred to a master to make and report an account of damages and profits accruing from defendant's infringement of said patents and that the damages reported be increased threefold in view of the wanton fraudulent and willful character of defendant's infringement; and that plaintiffs have judgment for the damages and profits so found, and for the costs of this suit.

(f) That plaintiffs have such other and further relief as equity may require.

May it please your Honors to grant unto plaintiffs a writ of subpœna issued out of and under the seal of this Honorable Court directed to said defendant, commanding it on a certain day and under a certain penalty to be and appear before this Honorable Court, then and there to answer to this Bill of Complaint and to stand to and abide by such further orders, directions and decrees as may be entered herein.

GENZO SHIMADZU,
By JUNICHI MIYATA,
Attorney in Fact.

NORTHEASTERN ENGINEERING CORPORATION,
By CHARLES B. BISHOP,
President.

HUNT, HILL & BETTS,
120 Broadway,
Borough of Manhattan,
City of New York, N. Y.
and
RAWLE & HENDERSON,
Fifteenth and Chestnut Streets,
City of Philadelphia, Pa.
Solicitors for Complainants.

JOSEPH W. HENDERSON,
GEO. WHITEFIELD BETTS, JR.,
J. T. NEWTON,
Of Counsel.

STATE OF NEW YORK,
CITY AND COUNTY OF NEW YORK,
SOUTHERN DISTRICT OF NEW YORK, } *ss:*

On this tenth day of May, 1933, at the City, County and State of New York, Southern District of New York, before me, a Notary Public in and for the County aforesaid, personally appeared Junichi Miyata, who, being first duly sworn, testified that he is the Attorney-in-Fact in the United States for Genzo Shimadzu, one of the plaintiffs named in the foregoing Bill of Complaint. That he has read and subscribed to the same for and on behalf of said Genzo Shimadzu and that he knows the contents thereof and that the same is true of his own knowledge except as to the matters therein stated to be on information and belief, and, as to those matters, he believes it to be true. That the sources of his information and the grounds of his belief are conversations with the said complainant and documents and papers submitted to

him by said complainant and in his possession pertaining to the matter aforesaid. That the reason this verification is not made by said plaintiff is that he is not now within the United States.

ISABELLE ROSE,
(Seal) *Notary Public.*
New York County No. 153.
New York Registers No. 5R73.
Commission expires March 30, 1935.

(N. Y. County Clerk's Certificate.)

No. 31502 Series D.

STATE OF NEW YORK, }
COUNTY OF NEW YORK, } *ss:*

I, Daniel E. Finn, Clerk of the County of New York, and also Clerk of the Supreme Court for the said County, the same being a Court of Record, having a seal, do hereby certify, That Isabelle Rose, whose name is subscribed to the deposition or certificate of the proof or acknowledgment of the annexed instrument, and thereon written, was, at the time of taking such deposition, or proof and acknowledgment, a Notary Public in and for such County, duly commissioned and sworn and authorized by the laws of said State, to take depositions and to administer oaths to be used in any Court of said State and for general purposes; and also to take acknowledgments and proofs of deeds, of conveyances for land, tenements or hereditaments in said State of New York. And further, that I am well acquainted with the handwriting of such Notary Public and verily believe that

the signature to said deposition or certificate of proof or acknowledgment is genuine.

In Testomony Whereof, I have hereunto set my hand and affixed the seal of the said (Seal) Court and County the twenty-seventh day of May, 1933.

DANIEL E. FINN,
Clerk.

UNITED STATES OF AMERICA,
STATE OF DELAWARE,
COUNTY OF NEW CASTLE, } *ss:*

On this twenty-fifth day of May, 1933, before me personally appeared Charles B. Bishop, who made solemn oath that he is the President of Northeastern Engineering Corporation, the plaintiff corporation in the foregoing Bill of Complaint, and that he has read and subscribed to the same for and in behalf of said corporation; that he knows the contents thereof and that the same is true of his own knowledge, except as to matters and things therein stated to be on information and belief, and that as to those matters he believes it to be true.

AVIS B. BISHOP,
(Seal) *Notary Public.*

(New Castle County Clerk's Certificate.)

STATE OF DELAWARE, } *ss:*
NEW CASTLE COUNTY, }

I, Harvey Hoffecker, Prothonotary of the Superior Court of the State of Delaware, in and for

New Castle County, which Court is a Court of Record, do hereby certify that Avis S. Bishop, before whom the annexed acknowledgment was taken, was at the time of taking such affidavit, affirmation or acknowledgment a Notary Public in the State of Delaware, of the County of New Castle, duly commissioned and sworn, and authorized to take and certify affidavits, affirmations and acknowledgments, and proofs of deeds or conveyance of lands, tenements and hereditaments in the State of Delaware and to all of whose acts as such full faith and credit are, and ought to be given, as well in Courts of Justice as elsewhere.

That I am well acquainted with the handwriting of said Notary Public and verily believe that the signature to said affidavit, affirmation or acknowledgment, purporting to be the signature of the said Avis S. Bishop is genuine.

In Witness Whereof, I hereunto set my hand and affix the seal of the said Superior Court, at Wilmington, this Twenty-fifth (Seal) day of May, in the year of our Lord one thousand nine hundred and thirty-three.

HARVEY HOFFECKER,
Prothonotary.

It is hereby certified that the within is a true and correct copy of the Original Bill of Complaint filed in the above-entitled matter.

JOSEPH W. HENDERSON,
GEO. WHITEFIELD BETTS, JR.,
Of Counsel.

ANSWER
(Filed Oct. 30, 1933.)

To the bill of complaint herein, defendant, The Electric Storage Battery Company, answers as follows:

1. Answering Section 1 of the bill, defendant admits the truth of the allegation.

2. Answering Section 2 of the bill, defendant has no knowledge as to whether or not the Northeastern Engineering Corporation is a corporation of Delaware or is a citizen or has a place of business in Wilmington, Delaware, and therefore denies such allegation.

3. Answering Section 3 of the bill, defendant admits that it is a corporation and a citizen and a resident as therein alleged, but denies that it has committed any infringing acts at the places therein referred to or elsewhere.

4. Answering Section 4 of the bill, defendant admits that this court has jurisdiction.

5. Answering Sections 5 and 6 of the bill, defendant admits that one of the patents in suit, No. 1,584,150 was granted on the 11th day of May, 1926, but is not informed except by the bill of complaint as to the truth of the other allegations there made and therefore denies the same and denies that said patent was duly or properly issued and granted.

6. Answering Sections 7 and 8 of the bill, defendant admits that another of the patents in suit, No. 1,584,149 was granted on the 11th day of May, 1926, but is not informed except by the bill of complaint as

to the truth of the other allegations there made and denies the same and denies that said patent was duly or properly issued and granted, and defendant avers that said letters patent 1,584,149 is void and invalid because the invention therein described and claimed had been patented in Japan on an application filed by the patentee more than twelve months prior to the application upon which said patent, 1,584,149, issued.

7. Answering Sections 9 and 10 of the bill, defendant admits that another of the patents in suit, No. 1,584,151, was granted on the 11th day of May, 1926, but is not informed except by the bill of complaint as to the truth of the allegations there made and therefore denies the same and denies that said patent was duly or properly issued and granted.

8. Answering Sections 11 and 12 of the bill, defendant admits that another patent in suit, No. 1,584,132 was granted on the 11th day of May, 1926, but is not informed except by the bill of complaint as to the truth of the allegations there made and therefore denies the same and denies that said patent was duly or properly issued and granted.

9. Answering Sections 13 and 14 of the bill, defendant admits that another of the patents in suit, No. 1,584,479, was granted on the 11th day of May, 1926, but is not informed except by the bill of complaint as to the truth of the allegations there made and therefore denies the same and denies that said patent was duly or properly issued and granted, and defendant avers that said letters patent 1,584,479, is void and invalid because the invention therein described and claimed had been patented in Japan on an application filed by the patentee more than twelve

months prior to the application upon which said patent, 1,584,479, issued.

10. Answering Sections 15 and 16 of the bill, defendant admits that another of the patents in suit, No. 1,896,020, was granted on the 31st day of June, 1933, but is not informed except by the bill of complaint as to the truth of the allegations there made and therefore denies the same and denies that said patent was duly or properly issued and granted.

11. Answering Section 17 of the bill, defendant is not informed except by the bill as to the truth of the allegation that plaintiff, Northeastern Engineering Corporation, was granted by the plaintiff, Shimadzu, an exclusive license for the whole of the United States, its territories and possessions, in respect to all of the patents in suit, together with the right to license others, and therefore denies the same.

12. Answering Section 18 of the bill, defendant is not informed, except by the bill as to the truth of the allegations to the effect that plaintiff, Shimadzu, has been and is vested with the legal title in and to the six patents in suit, and that plaintiff, Northeastern Engineering Corporation, has been and is vested with an exclusive license under said six patents in suit, and therefore denies the same.

13. Answering Section 19 of the bill, defendant is not informed, except by the bill, as to the truth of the allegation that licenses have been granted to the parties named, and therefore denies the same.

14. Answering Section 20 of the bill, defendant denies that, before the issue of the five patents first

mentioned in the bill or at any time, it by and through agents sought out the plaintiff in Japan and represented that it was interested in plaintiff's inventions; denies that it requested and was granted, by plaintiff Shimadzu, and had full access or any access to any plant in Japan operating the processes or producing the products or any of them referred to in the bill, and denies that it was given disclosure of all or any necessary mechanical and chemical details relating to said processes and products forming the basis of the patents set forth in the bill. Defendant denies that it requested the plaintiff, Shimadzu, to proceed or send a representative to Philadelphia to negotiate with it and to further explain and disclose the processes and products referred to in said patents and the details of the practical commercial operation thereof.

Defendant admits that one Lyuho S. Ishimura, in the year 1926, visited defendant and sought unsuccessfully to interest defendant in the purchase of a license under said five letters patent, and defendant denies each and every allegation contained in Section 20 of the bill.

15. Answering Section 21 of the bill, defendant denies all acts of infringement with which it is charged and denies each and every allegation contained in said Section.

16. Answering Section 22 of the bill, defendant admits the truth of the allegation thereof, except that the renewal of Hall's allowed application was not by or through the action of the defendant and except that application Serial No. 156,980 was filed as a renewal division.

17. Answering Section 23 of the bill, defendant

avers that the result of said proceedings was threefold: First, the issue to Hall on the 22nd day of November, 1932, of patent No. 1,888,823, containing process and product claims presented in his original application filed March 29, 1924, and allowed long prior to Shimadzu's visit in 1926 and long prior to the declaration of said interference and prior to the grant of said five patents to Shimadzu; second, the holding was that certain of the claims of Shimadzu's patents, copied by Hall for the purposes of interference and which Hall believed he had the right to copy and make for the purpose of bringing about an interference, were invalid; and third, Hall, although first in point of time in respect to the subject matter of his application filed in 1924, had no right to make the others of said claims copied from Shimadzu's patent, because these Shimadzu claims involve a specific product not specifically and in terms mentioned by Hall; therefore priority was awarded to Shimadzu in respect to such claims. Otherwise than as above, defendant denies the allegations of Section 23 of the bill.

18. Answering Section 24 of the bill, defendant denies all acts of infringement and denies the appropriation and use of any information, data or disclosure of Shimadzu's alleged inventions, and alleges that it was successfully making, using and selling its product long before it ever heard of Shimadzu or of his alleged inventions and patents.

19. Answering Section 25 of the bill, defendant denies all acts of infringement with which it is charged, but admits that it is practicing the process and making a product described and claimed in U. S. letters patent to Hall, No. 1,888,823, dated November

22, 1932, and which it used commercially and successfully long prior to any date of invention established by Shimadzu in said interference proceedings.

20. Answering Section 26 of the bill, defendant denies that it was duly notified of its alleged infringement upon the patents in suit.

21. Answering Section 27 of the bill, defendant denies that it has derived and received or is deriving or receiving any gains or profits and advantages from any infringement of any of said letters patent and denies all acts of infringement with which it is charged.

22. Defendant avers, on information and belief, that plaintiff, Shimadzu, well knowing that defendant was manufacturing the product and practicing the process now claimed to be an infringement as early as 1926, has delayed for substantially seven years before bringing this suit, and defendant having repeatedly denied infringement and relying upon plaintiff's inaction and believing that its business was legitimate, has expended large sums of money in and about the development of its said business and the construction of a large plant, and that plaintiffs are, by inaction, guilty of laches and are not entitled to the relief prayed for.

23. Defendant avers, on information and belief, that in view of the prior art, it required no invention to produce the said alleged improvements of said patents or any of them because the said improvements at the date of Shimadzu's alleged invention thereof were not patentable invention or improvement within the meaning of the law and not proper subject

matter for letters patent of the United States, and because said Shimadzu was not the original and first inventor or discoverer of the alleged inventions purporting to be covered thereby.

24. Defendant avers, on information and belief, that letters patent No. 1,584,149 are null, void and invalid in view of Japanese patent No. 41728 applied for November 21, 1920, and issued February 13, 1922, to said Shimadzu for Reactive Lead Powder, and Letters patent No. 1,584,479, are null, void and invalid in view of Japanese patent 42,861, applied for August 3, 1921, and issued June 17, 1922, for Process for the Manufacture of Pole Plates of Accumulators, to Shimadzu, and Japanese 42,862, applied for and issued on the same dates, for Pasted Accumulator Plates, to said Shimadzu.

25. Defendant avers, on information and belief, that all of said letters patent are null, void and invalid because all substantial and material parts thereof were described and patented in Japan and other foreign countries by said Shimadzu on applications filed more than one year prior to the filing of the corresponding patents in the United States.

26. Defendant avers, on information and belief, that said letters patent Nos. 1,584,149, 1,584,150, 1,584,479 and 1,584,151, are null, void and invalid in view of the disclosure of all substantial and material parts thereof in Belgian patent 284,885, filed February 4, 1920, issued March 15, 1929, and in the printed publication entitled Brevets deposes en Deuxiene Fascicule, 1920, published early in 1921, by the Belgian patent office in which said Belgian patent 284,885, is digested, and in British patent to Thomas Hyde, No.

19,981 of 1902, and in Elektrotechnische Zeitschrift of Nov. 3, 1893, page 635, in an article by Von C. Liebenow, and in Akkumulatoren Und Galvanischen Elemente by Dr. L. Lucas—1917, published by Max Jaenecke Leipzig, page 24, Paragraph 3, and in "Storage Battery Engineering" 3rd Edition, by Lamar Lyndon, published in New York, 1911 by McGraw Hull Book Company, page 185.

Defendant avers that the claims of said letters patent are invalid and void because the subject matter thereof was, prior to the alleged invention thereof by Shimadzu, and for more than two years prior to his application dates, known to and used by the defendant at Philadelphia, Pennsylvania, and by the Willard Storage Battery Company at Cleveland, Ohio.

27. That the description of the invention in the specification is not in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which it appertains or with which it is most nearly connected, to make, construct, compound and use the same. This refers to Patent 1,584,150.

28. Defendant avers, on information and belief, that the claims of each of said letters patent are invalid in view of the patents and printed publications set forth in Schedule A, hereto attached and made part hereof.

29. Defendant avers that plaintiff, Shimadzu, having successfully contended in the litigation referred to in Sections 22 and 23 of the bill, that the process and product are different from and do not embody the alleged invention of the Shimadzu patent, 1,584,150, is estopped from alleging infringement thereof in this suit.

Wherefore defendant prays that the bill be dismissed with costs to be allowed to the defendant.

THE ELECTRIC STORAGE BATTERY COMPANY
By JOHN R. WILLIAMS,
President.

(Seal)
Attest

WALTER G. ANDERSON,
Secretary.

Solicitors and of Counsel.
AUGUSTUS B. STOUGHTON,
HUGH MORRIS,
A. F. KWIS,
EDW. S. W. FARNUM, JR.

SCHEDULE A.

JAPANESE PATENTS TO PLAINTIFF, SHIMADZU.

#40,704 — PAINT.

Applied for Dec. 9, 1920
Issued Nov. 18, 1921

#41,728 — REACTIVE LEAD POWDER.

Applied for Nov. 21, 1920
Issued Feb. 13, 1922

#41,953 — MFG. OF LITHARGE BY MEANS OF NATURAL OXIDATION.

Applied for Aug. 29, 1920
Issued March 10, 1922

#42,562 — Addition to 41,728 REACTIVE LEAD POWDER.

Applied for Nov. 27, 1920
Issued May 10, 1922

#42,563 — REACTIVE LEAD POWDER.

Applied for Nov. 27, 1920
Issued May 10, 1922

#42,564 — REACTIVE LEAD POWDER.

Applied for Nov. 27, 1920
Issued May 10, 1922

#45,093 — MANUFACTURE OF ELECTRODES FOR STORAGE BATTERY BY USE OF LEAD SUBOXIDE.

Applied for June 1, 1922
Issued March 31, 1923

#60,825 — LEAD SUBOXIDE POWDER CONTAINING METALLIC LEAD.

Applied for Feb. 3, 1923
Issued June 19, 1924

#42,861 — PROCESS FOR MFG. OF POLE PLATE OF ACCUMULATOR.

Applied for August 3, 1921
Issued June 17, 1922

#42,862 — PASTED ACCUMULATOR PLATE.

Applied for August 3, 1921
Issued June 17, 1922

BRITISH PATENT TO PLAINTIFF, SHIMADZU.

#176,924 — LEAD OXIDES AND PROCESSES TO MANUFACTURE SAME.

Applied for Dec. 20, 1920
Accepted March 23, 1922

#197,031 — IMPROVEMENTS IN METHODS OF MANUFACTURE OF METAL POWDER.

Applied for Feb. 7, 1922
Issued May 7, 1923

#218,119 — METHOD—
POWDER OF LEAD SUBOXIDE INTERMINGLED WITH POWDER OF METALLIC LEAD.

Applied July 18, 1923
Issued July 3, 1924

#236,368 — PROCESS OF MANUFACTURING LEAD OXIDES.

Applied for June 26, 1924
Issued July 9, 1925
Refers to 176,924. 198,647 and 215,222

#263,644 — APPARATUS FOR CONTINUOUS PRODUCTION OF LEAD OXIDES IN THE DRY STATE.

Applied for Jan. 27, 1926
Issued Jan. 6, 1927

BRITISH PATENTS.

Hyde #19,981 — AN IMPROVED METHOD OF AND APPARATUS FOR PULVERIZING METALLIC LEAD, &c.

Applied for Sept. 12, 1902
Accepted May 21, 1903

Coleman #14,794 — IMPROVED PROCESS AND APPARATUS FOR THE MANUFACTURE OF WHITE LEAD, &c.

Applied for Aug. 16, 1892
Accepted Sept. 24, 1892

BISCHOF #13,202 — IMPROVEMENTS IN APPARATUS FOR REDUCING LITHARGE AND OTHER LEAD OXIDES TO SUBOXIDES.

1898

UNITED STATES PATENTS.

BAILEY #846,384 — LEAD PRODUCT.
Applied for June 26, 1902
Issued March 5, 1907

THIBAULT #846,444 — PROCESS OF MAKING METALLIC OXIDES.
March 12, 1907

THIBAULT #1,482,327 — PRODUCTION OF METAL OXIDES, ESPECIALLY LEAD OXIDES.
Applied for January 5, 1920
Issued January 29, 1924

HALL #1,888,823 — LEAD OXIDE POWDER AND METHOD OF MAKING THE SAME.
Applied for March 29, 1924
Renewed December 24, 1926
Issued November 22, 1932

HALL #1,675,345 — APPARATUS FOR MAKING LEADEN POWDER.
Applied March 29, 1924
Issued July 3, 1928

HARDINGE #1,450,289 — APPARATUS FOR ENTRAINING AND REMOVING FINES FROM CONICAL MILLS.
Filed April 29, 1920
Issued April 3, 1923

HUFFARD & HAYNES #1,491,237 — PROCESS AND APPARATUS FOR OXIDIZING LEAD.

PETERS =1,441,168 — PAINT COMPOSITION AND PROCESS OF MANUFACTURING THE SAME.

JANUARY 2, 1923

MARTIN =207,264 — SUBOXIDE IN PAINT.
Applied November 16, 1877
Issued August 27, 1878

FULLMAN =1,174,975 — TUMBLING BARREL.
March 14, 1916

WEBSTER & GIBBS =406,378 — APPARATUS FOR COMMINUTING AND CORRODING LEAD.

July 2, 1889

HOLLEY =1,123,743 — PROCESS OF MAKING PIGMENTS.

January 5, 1915

FRENCH PATENT.

Jacques Antoine Thibault — GRINDING LEAD BALLS IN A MILL.
Issued Sept. 4, 1919 =494,270.

BELGIAN PATENT.

=284,885 — MECHANICAL METHOD OF MAKING POWDER FROM LEAD OR LITHARGE AND OTHER OXIDES OF LEAD, TO STE. ANNE ACCUMULATEURS TUDOR a BRUXELLES.

Applied for February 4, 1920
Issued March 15, 1920

PRINTED PUBLICATION.

Brevets déposés en	Brevetten neergelegd in 1920.
Deuxieme Fascicule	Tweede Aflevering

E.—INDUSTRIES CHIMIQUES. SCHEIKUNDIGE BEDRIJVEN

ACCUMULATEURS TUDOR, société anonyme, 79, rue Joseph II, á Bruxelles.

UNITED STATES PATENTS.

Wm. L. Silvey #645,978 — SECONDARY BATTERY.
March 27, 1900

E. A. Sperry #723,327 — IMPROVEMENTS IN STORAGE BATTERIES.
Applied for August 12, 1901
Issued March 24, 1903

NOTICE OF MOTION FOR LEAVE TO AMEND ANSWER.

(Filed June 8, 1935.)

Please take notice that on Wednesday, the 12th day of June, 1935, at Ten O'clock in the forenoon, or as soon thereafter as counsel can be heard, at the United States District Court for the Eastern District of Pennsylvania, at the Post Office Building, 9th & Chestnut Streets, City of Philadelphia, State of Pennsylvania, the attached amended answer will be presented and the court will be asked for leave to file it.

E. S. W. Farnum, Jr.,
Augustus B. Stoughton,
Hugh M. Morris,
Solicitors and of Counsel for Defendant.

To:

Joseph Henderson, Esq.,
Rawle & Henderson,
Packard Building,
Phila., Pa.,
Solicitors and of Counsel for Plaintiffs.

AMENDED ANSWER.

Now comes The Electric Storage Battery Company, defendant herein, and by leave of court first had and obtained, amends its answer as follows:

By adding immediately after paragraph 29 on page 9, of its printed answer the following paragraph:

30. Defendant avers that the said Letters Patent No. 1,584,150, to Shimadzu are void for unreasonable neglect or delay in disclaiming claims 9 to 13 thereof, inclusive, covering subject matter which Shimadzu was not the original or first inventor or discoverer, and, therefore, invalid, and held to be unpatentable over the patent No. 1,482,327, of January 29, 1924, to J. A. Thibault, for Production of Metal Oxides, Especially Lead Oxides, by the Law Examiner of the Patent Office under date of February 18, 1928, in Interference Hall vs. Shimadzu, No. 54,798. Record U. S. Court of Customs and Patent Appeals, Nos. 2982, and 2983, page 200.

E. S. W. Farnum, Jr.,
Augustus B. Stoughton,
Hugh M. Morris,
Solicitors and of Counsel for The Electric Storage Battery Company.

Dated June 7, 1935.

NOTICE OF MOTION.

(Filed Dec. 19, 1933.)

Please take notice that we shall present the accompanying motion before the United States District Court at the United States Post Office Building in the City of Philadelphia, Pennsylvania, on the day of November, 1933, at 10 A. M., or as soon thereafter as counsel can be heard.

Dated, November 16, 1933.

Yours, etc.,

JOSEPH HENDERSON,
RAWLE & HENDERSON,
Solicitors for Plaintiff,
Office & P. O. Address:
Packard Building,
Fifteenth and Chestnut Streets,
Philadelphia, Pa.

HUNT, HILL & BETTS,
Solicitors for Plaintiff.
Office & P. O. Address:
120 Broadway,
Borough of Manhattan,
New York, N. Y.

To:
AUGUSTUS B. STOUGHTON,
EDWARD S. W. FARNUM, JR., Esqrs.,
Solicitors for Defendant.

MOTION.
(Filed Dec. 19, 1933.)

Now come the plaintiffs, Genzo Shimadzu and Northeastern Engineering Corporation, plaintiffs, by their attorneys, and upon the pleadings and proceedings herein and upon the annexed affidavit of James T. Newton, verified the 13th day of November, 1933, move the court for an order permitting plaintiffs' representatives, counsel and qualified experts to inspect the defendant's plant, to observe the apparatus used and the method employed by defendant in its manufacture from raw lead of its products, including those for use with paints and for storage batteries

manufactured and sold by it, said order to provide for:—

(1) the furnishing to plaintiffs ten days before the time of said inspection of complete dimensional elevation and plan drawings to scale, showing internal, as well as external, construction of defendant's apparatus, including lead feeding and product collecting equipment, said drawings to indicate clearly and accurately the location and nature of every indicating and recording instrument or device used in connection with the operation of the apparatus, a separate set of drawings to be furnished for each different type of apparatus employed by defendant.

(2) the furnishing to plaintiffs for examination ten days before the time of said inspection of one freshly made normal two-pound sample of material, freshly obtained from each discharge point of the apparatus, and labelled to identify for plaintiffs its point of discharge, properly sealed for preservation, samples to represent each product manufactured in each different type of apparatus employed by defendant.

(3) the making available to plaintiffs of all records of operating data and product analysis for a period beginning two years before filing of the bill herein up to and including the period of inspection of defendant's apparatus by plaintiffs, such records to remain available to plaintiffs until completion of the trial.

(4) the furnishing to plaintiffs ten days before the time of said inspection a battery manufactured in accordance with the process and with the products used by defendant in its regular business as em-

ployed by it within three months of the filing of the bill of complaint herein.

(5) said inspection to include the observation of the normal use of the apparatus employed by defendant and the methods employed by it, together with the observation of customary engineering tests to be made in the presence of plaintiffs' experts and representatives with the defendant's apparatus, when conducted by the defendant in its regular method of operating the apparatus substantially identical to that employed by it in the production of the battery referred to above; including the starting of a freshly cleaned apparatus with a fresh charge of metallic lead, together with any other constituents, normally employed in starting the operation of the apparatus, running the same until the apparatus has come up to normal operation and thereafter continuing such operation for a period of from one to two days under normal operating conditions; taking the temperatures and all pertinent readings such as the speed of revolutions of the apparatus, amount of air employed, the load, amount of water and or steam used inside or outside of the apparatus, etc., etc.; also permitting plaintiffs to take any samples they may desire at any time during said tests and upon termination thereof, to cause the apparatus to be stopped and immediately to take samples of the contents of the apparatus and to inspect the interior of the apparatus; and that the instruments employed in the test observed by plaintiffs be calibrated both before and after said tests by a competent concern to be agreed upon by the parties or designated by this Honorable Court; the production of all the sheets of all recording instruments used during said tests, together with corresponding

data sheets normally used by defendant in the conduct of its business to be lodged with the Clerk of the Court for use at the trial.

JOSEPH HENDERSON,
RAWLE & HENDERSON,
Solicitors for Plaintiffs.
Office & P. O. Address:
Fifteenth & Chestnut Streets,
Philadelphia, Pa.

HUNT, HILL & BETTS,
Solicitors for Plaintiffs.
Office & P. O. Address:
120 Broadway,
New York, N. Y.

Dated: November 16, 1933.

DISTRICT OF COLUMBIA }
CITY OF WASHINGTON } *ss:*

I, James T. Newton, being duly sworn, doth depose and say that I am of mature age and reside at 1625 R Street, N. W., Washington, D. C. I am a Patent Attorney and Patent Expert and have an office in the National Press Building, Washington, D. C. After graduating with the Degree of Bachelor of Engineering, I took the U. S. Patent Office entrance examination and was appointed to the Patent Office in 1891 as an Assistant Examiner. I passed through the various grades of Examiner, member of the Board of Appeals, Assistant Commissioner of Patents and resigned after three years service as Commissioner of Patents, in July, 1920. Since that time I have been engaged in the prosecution of applications for pat-

cuits and in expefting patent cases before the Federal Courts of this Country.

I have read over and understand the Shimadzu patents Nos. 1,584,149-150-151,152, 1,584,479 and 1,896,020, involved in this suit, and I believe I know what those patents cover.

I was engaged in my professional capacity from 1927 to 1933 in the prosecution of two interferences in the United States Patent Office, Hall v. Shimadzu, Nos. 54,798 and 56,224, which were instituted pursuant to the request of the party Hall, the party Hall being an employee of the defendant herein. The inventions involved in those contests, together with others, are involved in the present suit, Shimadzu and Northeastern Engineering Corporation v. The Electric Storage Battery Co.

The interferences referred to passed through the regular proceeding to a decision by the Examiner of Interferences, by the Board of Appeals in the United States Patent Office upon an appeal to that Tribunal and thereupon by the Court of Customs and Patent Appeals, Washington, D. C., all Tribunals deciding in favor of the party Shimadzu, the plaintiff herein.

It was the contention of said Hall and other employees of the Electric Storage Battery Coompany that the machines in operation at the factory of the Electric Storage Battery Company did produce a product substantially identical with that disclosed and claimed in the Shimadzu patents involved in this suit and that the process employed likewise was similar to the processes of the Shimadzu patents.

It is my opinion, therefore, that The Electric Storage Battery Co., by its employees who testified in the Hall v. Shimadzu interference proceedings, gave ample reasons to cause the belief that the Electric Storage Battery Company was and is infringing the afore-

said Shimadzu patents, as was alleged in plaintiffs' bill of complaint herein.

However, in the opinion of deponent, more detailed and accurate information is necessary to plaintiff in order to properly make out this cause of action against defendant and to this end the exact apparatus used by defendant, the particular and precise process or steps used and employed by defendant in producing this product and the exact physical and chemical properties of the product are facts within the knowledge of the defendant, which, however, are not available to plaintiff because of the fact that the product produced is not a product which may be obtained on the market nor, of course, is there any way of ascertaining the exact and precise steps of the process employed by defendant without an actual inspection and the observation of tests conducted upon the apparatus employed by defendant in its plant at Philadelphia.

Further deponent saith not.

Subscribed and sworn to
before he this 13th day of JAMES T. NEWTON.
November, 1933.

CATHARINE S. WILTON,
(Seal) *Notary Public, D. C.*

AFFIDAVIT OF LUYHO S. ISHIMURA.
(Filed Dec. 19, 1933.)

CITY, COUNTY AND STATE OF NEW YORK) ss:
SOUTHERN DISTRICT OF NEW YORK)

Luyho S. Ishimura, being duly sworn, deposes and says:

I am of mature age and an engineer by profession sojourning presently in the City, County and State of New York. After obtaining technical training in Japan I came to this country as a special Government student to continue my studies and graduated from the Polytechnic Institute of Brooklyn in 1916, with the degree of Mechanical Engineer. I then returned to Japan and entered into the employ of the plaintiff Shimadzu herein at Kyoto, Japan, in 1917, and have since been engaged with him in the development of the manufacture of lead oxides and of the patents in suit, and in the storage battery industry.

During February, 1926, one C. Reed Cary, then Vice-President of Leeds & Northrup Company of Philadelphia, Pennsylvania, visited Japan and began to negotiate with the Shimadzu Manufacturing Company, of which the plaintiff Shimadzu is the President, for the establishment of a Japanese agency of the Leeds & Northrup Company to handle the sales of its products. At this time, the plaintiff Shimadzu spoke to said Cary about his new inventions dealing with lead oxide and suboxide products and expressed his desire to interest parties in the United States to acquire rights under his American applications. To this said Cary gave a very promising reply and stated that he could possibly interest one of the largest storage battery companies in the United States, and began to enquire into the processes and operating data and products of the Shimadzu inventions, and was shown through the Shimadzu plants in Kyoto, Japan. Said Cary represented and stated that, although he was connected with the Leeds & Northrup Company, he had very close connections with the Electric Storage Battery Company (defendant herein), and shortly thereafter returned to this country with literature

and various disclosures and data relating to said inventions submitted by said Shimadzu. All the foregoing was reported to me in full by the said Shimadzu and his engineers who were present at the Cary-Shimadzu negotiations, was subsequently confirmed to me personally by officials of said Electric Storage Battery Company, and is a true statement of facts, to the best of my knowledge and belief.

When said Cary returned to the United States he transmitted the results of his observations and his negotiations and the data he had obtained, to the Electric Storage Battery Company, resulting in the latter's request to plaintiff Shimadzu to send his representative to Philadelphia to negotiate for the license and/or sale of the Shimadzu inventions, which are the subject of this suit.

I was selected to represent the plaintiff Shimadzu in said negotiations, and proceeded to Philadelphia, Pennsylvania, and in May, 1926, entered into conversations and negotiations in respect of said inventions with several representatives of The Electric Storage Battery Company, among whom were one Herbert Lloyd, President of said Company, one Edward W. Smith, its factory engineer, one Clarence A. Hall, its Chief Engineer, and Augustus B. Stoughton, Esq., counsel for defendant in this suit. Such representatives of The Electric Storage Battery Company stated to me that that Company was interested in the inventions and wanted to acquire rights under the said Shimadzu patents covering same, and requested me to disclose to them commercial operating and other technical data in respect thereof.

In response to said requests, and relying upon said statements, I furnished said representatives with full information and data relative to said Shimadzu

inventions. A contract for the sale of the Shimadzu patents to said Electric Storage Battery Company was drafted and submitted to said Lloyd, President of The Electric Storage Battery Company, all of which information, data and contract draft they have and still retain.

During August, 1926, when I visited J. R. Williams, Second Vice-President of the defendant herein. I learned to my surprise that both Mr. Lloyd and Mr. Stoughton had gone to Europe on their vacations and that nothing could be decided upon until Mr. Lloyd's return. As they had not indicated any intention of terminating the negotiations I returned to Japan to take up the matter further with Mr. Shimadzu personally, with the intention of coming back to this country.

In the meantime, while these negotiations and disclosures were going on, one Clarence A. Hall, Chief Engineer of The Electric Storage Battery Company, had pending in the United States Patent Office an application for making certain lead products and processes relating thereto, bearing Serial Number 720,889, filed March 20, 1924, allowed February 6, 1926, and which application became forfeited on August 6, 1926. On December 26, 1926, and subsequent to said disclosures and during said negotiations above mentioned said Hall renewed his forfeited application and filed other applications at this time incorporating therein certain claims taken verbatim from the United States Shimadzu Patent #1,584,150 and also from certain claims of the United States Shimadzu Patent #1,584,152. Thereupon said Hall, under the directions and authority of the said The Electric Storage Battery Company and at its expense, unexpectedly caused to be instituted in the

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United States Patent Office in January, 1927, two interferences, Numbers 54 798 and 56,224, between the said Hall applications and the Shimadzu patents.

I was in the United States during the entire pendency of said interferences, served as a witness for the plaintiff Shimadzu, and as an expert advisor to counsel representing said Shimadzu therein. I was present when all depositions for both parties to said interferences were taken, and was in attendance at all hearings held in connection therewith.

Testimony was taken by both parties to the interferences. Hall and other employes of said The Electric Storage Battery Company who testified on its behalf repeatedly admitted that the said Company was manufacturing the products disclosed and claimed in said Shimadzu patents. All the tribunals of the United States Patent Office, as well as the Court of Customs and Patent Appeals, rendered decisions in favor of the plaintiff Shimadzu herein and awarded priority to Shimadzu. The Court of Customs and Patent Appeals rendered its decision on June 20, 1932, affirming the decisions of the tribunals below that said Hall was not entitled to the claim incorporated as aforesaid in his applications and that Shimadzu was the first inventor of said inventions in issue.

From the foregoing facts and other facts relating to the details of the various contacts had from time to time between representatives of plaintiff Shimadzu and representatives of The Electric Storage Battery Company, deponent submits that there is clear ground to believe that The Electric Storage Battery Company and its representatives and employes procured the aforesaid disclosures and operating data from the plaintiff Shimadzu in the manner above

stated under the guise of an intent to acquire rights under the said Shimadzu inventions and patents, and have been and now are wrongfully utilizing and appropriating the same, together with the said Shimadzu inventions to the advantage of said The Electric Storage Battery Company.

Moreover, the inventions and processes involved in this suit are highly technical and complicated. The products from metallic lead obtained by these inventions cannot be purchased or procured in the open market, and the chemical elements and changes, operating conditions, the degree of oxidation, etc. of the metallic lead, among other elements, are so peculiarly minute and difficult of scientific ascertainment that the clearest and only satisfactory method of furnishing these details is by actual inspection and observation of the plant and apparatus of the defendant operating under normal conditions, and careful analysis of samples of the product or products thereof taken in such a manner as to preclude the possibility of physical and/or chemical changes occurring during the interim between their manufacture and the time they are analyzed.

Furthermore, from my long association and study of the art involved in this suit and of said Hall patent and my knowledge of the plaintiff Shimadzu's patents and information given by employes of The Electric Storage Battery Company, I can safely state that the processes and methods employed and the product obtained by the defendant are substantially identical with the inventions of the plaintiff Shimadzu described and claimed in his said patents in suit. The defendant's witnesses and employees in the

interference proceedings repeatedly admitted and testified that such was the fact.

Sworn to before me this
11th day of December, 1933. LUYHO S. ISHIMURA.

ISABEL W. BONNER,
(Seal) *Notary Public.*
New York Co. No. 244.
Register's Office No. 48242.
Commission Expires Mar. 30, 1934.

ANSWER TO MOTION AND AFFIDAVITS.
(Filed Jan. 30, 1934.)

Defendant answering Plaintiffs' Motion says:

1. Plaintiff is a competitor of Defendant. Defendant is the largest manufacturer of storage batteries in the world, and is the oldest manufacturer of storage batteries in the United States, having been continuously engaged therein since 1888.

Plaintiff has licensed manufacturers of storage batteries engaged in competition with the Defendant, as appears by paragraph 19 of the Bill of Complaint, and plaintiff, Shimadzu, is directly or indirectly engaged or interested in manufacturing storage batteries in Japan, as appears by paragraph 20 of the Bill of Complaint.

The Plaintiff, Northeastern Enginering Corporation, is a licensee of the Plaintiff, Shimadzu, and other licensees of the plaintiff are set out in paragraph 20 of the Bill of Complaint.

Of said licensees the U-S-L Battery Corporation is extensively engaged in the manufacture and sale of

storage batteries and is one of the principal competitors of Defendant.

The remaining licensees of the Plaintiff Shimadzu, so far as enumerated in paragraph 19 of the Bill of Complaint, with the exception of Plaintiff, Northeastern Engineering Corporation, are affiliated with the U-S-L Battery Corporation.

PARAGRAPH 2.

During the long period of existence of Defendant it has been engaged not only in the manufacture of storage batteries, but as well in the manufacture of storage batteries of the highest quality in the most efficient manner. To bring about that result Defendant has been constantly engaged, with a great degree of success, in endeavoring to manufacture the highest possible grade of produce with a maximum of efficiency and minimum cost. In such endeavor Defendant has from time to time improved the design, construction and physical combination of the various instrumentalities entering into the operation of the plant to produce a continuous uninterrupted sequence of operation.

The result of the Defendant's continuous effort through the years has been not only a product of the highest grade of quality but a plant set-up and arrangement of the highest efficiency which has enabled Defendant to manufacture its product at a much less cost than it could otherwise do. This result of Defendant's expenditure and effort is an asset of Defendant of great value which it should not be called upon to supply to its competitors without cost or otherwise unless such disclosure be shown to be indispensable to the proper determination of the cause by the Court.

PARAGRAPH 3.

Plaintiffs have not shown that they are entitled to obtain by means of this motion or otherwise the aforesaid valuable asset of this Defendant. Nor have Plaintiffs shown any right whatsoever or any ground upon which they may properly obtain an inspection of Defendant's plant or have Defendant supply to them the information and materials which they seek.

Lead oxide powder for making plates for storage batteries and the process by which it is made, first came to the attention of the Defendant in the summer of 1907, during the presence in Germany of one of its engineers. At that time little if anything was known about lead oxide powder in this country and its use in the battery business.

During 1908 the Accumulatoren-Fabrik Aktiengesellschaft, Hagen, Westphalia, Germany, sent to Defendant a large size sample of lead oxide powder with which a number of plates were pasted and the plates were tested by the Defendant.

In 1909 a second importation of German lead oxide powder was made and a further lot of plates pasted. Some of the plates were pasted in Germany and some in this country.

Subsequently in 1912 and 1913 an engineer of Defendant paid a visit to Germany and obtained very full details of the working of this process and of the employment of the resulting lead oxide powder in making storage battery plates.

The defendant in this suit then had and now has an agreement with The Accumulatoren-Fabrik Aktiengesellschaft, for the exchange of engineering information.

The lead oxide powder gave such satisfactory results that in 1915 the defendant put up in Philadel-

phia, a mill similar to mills used by the Accumulatoren-Fabrik Aktiengesellschaft for the manufacture of the material, and this mill fas completed during 1916.

Operation of this mill was commenced in 1916 and large numbers of plates were made by Defendant from the resulting lead oxide powder.

The experience with plates made from this lead oxide powder was so successful that late in 1916, twenty batteries were sold to the New York Railways Company and put into operation. This initial order was followed later on by another set of plates going to the same company made with this same lead oxide powder, and they were put into operation in 1918. The magnitude of this operation can be gathered from the fact that these batteries contained approximately 19,000 plates made of this lead oxide powder.

Further the defendant installed a larger lead oxide powder plant which was finished and put into operation early in January, 1921. During its operations from 1921 to 1923 the defendant produced approximately three and one half millions lbs. of lead oxide powder.

The mill so employed in 1921 is illustrated and described in patent No. 1,675,345, and the process and product are described in patent No. 1,888,823, both to C. A. Hall.

The product made by the Defendant in 1921, is the same as the product made by it at the present time, and the process and apparatus employed are identical.

The product made by the German Company since 1907 and imported into this country, and made in this country by defendant beginning in 1916, and the product made in this country since 1921 and now made

by defendant, are substantially identical. Storage battery plates made of the two products are identical in all substantial and material respects.

Before defendant first learned of Shimadzu or had brought to its attention or to the attention of any of its engineers or employees, patents or any other publications for which Shimadzu was responsible, defendant had made and used in storage batteries of its manufacture over 10,000,000 lbs. of lead oxide powder made by substantially the same process as that now employed by defendant. (See Paragraph 18 of defendant's answer.).

2. The suit is without probable cause and no prima facie case of infringement has been made.

(a) In interference litigation between Hall and Shimadzu involving some of the same subject matter at the present suit at page 223 of the printed record, submitted herewith, the Board of Appeals on Nov. 26, 1930, found as follows: "We consider that Hall's testimony as corroborated by Shaw and Exhibit No. 1 established that Hall operated a Hardinge mill to produce the powder as variously described by the witnesses early in 1921."

The United States Court of Customs and Patent Appeals, 59 Fed. Rep. (2nd) p. 225, affirmed the decision of the Board.

Hall's date for manufacturing the lead oxide powder thus established, early in 1921, is more than two years before Shimadzu filed his application for a patent in July of 1923.

The United States Court of Customs and Patent Appeals by its decision decided that the process and product of Hall, dating from early in 1921, were not the same but were different from Shimadzu's inven-

tion involved in the interference and that by reason of this difference Hall was not entitled to make Shimadzu's claims. According to the practice in such cases, priority was awarded to Shimadzu and, by reason of this holding and of the fact that Hall was prior in point of time with his lead oxide powder and process, there was issued to Hall on November 22, 1932, Patent No. 1,888,823, containing process and product claims which he presented in his original application filed March 29, 1924. All this is set up in Paragraph 17 of Defendant's Answer.

(b) Defendant in no way conceals its process and product and in Paragraph 19 of its Answer states that it is practicing the process and making the product described and claimed in its Patent No. 1,888 823, and which it has used commercially and successfully long prior to any date of invention established by Shimadzu in the interference proceedings.

(c) In the interference proceedings Shimadzu was held to his filing date of July 1923, and Hall was given a date for his process and product early in 1921. Hall's patent No. 1,888,823, shows the character of apparatus employed and it was established in the interference that it was a Hardinge mill which is a well known apparatus shown in Letters Patent No. 1,450,289, of April 3, 1923.

(d) Of the Patents in suit No. 1,584,479, is void on Japanese patent No. 42,861, both to Shimadzu.

No. 1,584,149, is void on Japanese patents 41,728, and 42,563, both to Shimadzu.

No. 1,584,150 is void on 41,728 and 42,563, both to Shimadzu and also on British patent No. 197,031.

The reason is that the Japanese patents issued prior to the United States patents on applications filed in Japan more than one year prior to the date of

filing of the United States applications. Rev. Stat., sec. 4887. 35 U. S. C. 32.

(e) Certain claims of Patent No. 1,584,150, in suit were held invalid by the Law Examiner in the Patent Office in view of a prior patent to Thibault No. 1,482,327, Record of the interference proceedings, page 200. The claims in question so held invalid are 8 and 10 to 14.

(f) Patent No. 1,584,152 in suit relates to paint. Defendant has not since 1926 made any paint containing lead oxide powder, and prior to 1926 made a small quantity of such paint for experimental purposes only.

(g) There are 43 claims in the patents in suit and although requested so to do, the plaintiffs have refused to state which of the claims they will rely upon.

REQUESTS OR INTERROGATORIES OF THE MOTION.

Plaintiffs ask Defendant what process and apparatus it uses and product it makes. Plaintiffs do not ask Defendant if it is using certain things set forth in its patent.

Request 1 asks detailed information of external and internal construction of Defendant's apparatus, including auxiliary appliances, and asks for drawings to indicate the location of recording instruments not for one apparatus but for every type of apparatus. The request is in no way limited but is directed to all of Defendant's apparatus.

Request 2 asks for freshly made samples of material without specifying in any way what kind of material other than to say each product manufactured

in each different type of apparatus employed by the Defendant.

Request 3 asks for all record and operating data and product analyses for the last four years; again without specifying in any way to what they relate.

Request 4 calls for a battery manufactured in accordance with any process or any product that the Defendant may use and like the other requests has no reference to any patent or patents.

Request 5 asks for an inspection of everything that the Defendant does, together with specially conducted tests involving the calibration of instruments and many other special conditions.

Preceding these itemized requests the Plaintiff wants to observe the apparatus and methods employed by the Defendant in its manufacture beginning with metallic lead and ending with paints and complete batteries.

This fishing expedition is supported by the affidavit of one of Plaintiffs' counsel, and by Ishimura.

ARGUMENT IN SUPPORT OF ANSWER.

In Sinclair Refining Co. v. Jenkins Petroleum Process Co., Advance Reports, Vol. 77, No. 14, 1932 Term, page 900, the Supreme Court was considering the question of inspection of drawings and designs of a bill for discovery of damages filed in aid of an action at law. While the procedure differs from the present procedure we submit that the question involved is the same. The Supreme Court said:

> "To hold that the plaintiff in an action at law may have discovery of damages is not to say that the remedy will be granted as of course; or that protection will not be given to his adversary against impertinent intrusion. Wigram, supra, Par. 115. The Court may decline to open the de-

fendant's records to the scrutiny of a competitor posing as a suitor, if the suit has been begun without probable cause or as an instrument of malice."

* * * * * * * * *

"Only the most general facts are to be discovered in advance of trial."

* * * * * * * * *

The Court refers to "cases where inspection during the trial and in the presence of the jury will produce delay or inconvenience."

* * * * * * * * *

We submit that the present motion is an impertinent intrusion of a competitor posing as a suitor and that the suit is begun without pobable cause as an instrument of malice in the sense of a design of doing mischief to the Defendant. As such, under the Rule announced by the Supreme Court, the Plaintiff is not entitled to inspection.

In Eibel Process Co. v. Remington-Martin Co., 197 Fed. Rep. page 760, the District Court, N. D., N. Y., held that suspicion of infringement is not enough to justify an order of inspection and production. Also that a prima facie case should be made by taking testimony, we presume that a prima facie case of infringement is referred to, and that concealment by the Defendant is necessary to justify an inspection.

In Gasoline Products Co., Inc. v. American Refining Co., 12 Fed. Rep. (2nd) page 98, D. C., Del., it was held that in the case of a license the plaintiff may ask the Defendant if it is using some defined apparatus but cannot ask broadly and generally what apparatus Defendant is using.

In the last case reference is made to New Jersey Zinc Co. v. Du Pont De Nemours & Co., Inc., 11 Fed.

Rep. (2nd) page 908, in which the District Court of Delaware held that in a patent case the plaintiff may not ask what structure, process and the like the Defendant is using.

On the face of the papers the only attempt to meet the requirement, that where a plaintiff seeks an order of inspection he must show probable cause or a prima facie case of infringement, is the allegation in the affidavit of one of plaintiffs' counsel, and in the affidavit of Ishimura, and analyzed they amount to this: In the interference proceedings Hall contended that the subject matter of his application for a patent included the subject matter of the claims of some of Shimadzu's patents here in suit and his witnesses supported that contention. However, the decision of the Court of Customs and Patent Appeals is that the subject matter of Shimadzu's claims and the subject matter of Hall's application, which resulted in the patent under which the Defendant has operated and is operating since 1921, are different and not the same. Nevertheless in the supporting affidavits the only thing alleged to show probable cause or a prima facie case of infringement is that Hall's witnesses stated that the subject matter of Hall and Shimadzu was the same. Inasmuch as the decision of the Court of Customs and Patent Appeals was to the effect that Hall's witnesses were wrong and the subject matter of the two parties was in fact different, it is impossible to understand how Plaintiffs can imagine that the testimony of Hall's witnesses establishes a prima facie case of infringement or probable cause. At the present time the law of the case is that the subject matter of the application, now patent, of Hall and the patent to Shimadzu are for different subject matter which certainly establishes non-infringement. Again Shimadzu having successfully contended that the sub-

ject matter of Hall's application, now patent, and the subject matter of Shimadzu's patent are not the same and obtained an affirmance of a judgment to that effect, is estopped from making the present contention. In a general way section 17 of Defendant's Answer states these facts and section 29 of the Answer sets up this estoppel.

It has been shown that plaintiff is a competitor posing as a suitor and that the suit is begun without probable cause as an instrument of malice, in the sense of a design of doing mischief to the defendant, and we may add as an instrument of doing the plaintiff great commercial gain. For Plaintiff to obtain full and detailed information of all Defendant's doings, from raw lead to finished product, as requested, would put Plaintiff in a position to duplicate the Defendant's manufacture in Japan with cheap labor, thereby doing Defendant serious mischief, and further would enable Plaintiff to give such information to Defendant's competitors in the United States and elsewhere as an inducement to take licenses under Plaintiffs' patents, with the advantages of defendant's improved design, construction and physical combination of instrumentalities comprising a plant for the practice of a continuous, uninterrupted sequence of operation, and with the advantage of automatic and other machinery and appliances devised by defendant and in no way related to or connected with plaintiffs' patents or any of them.

This Court is asked to take from defendant and give to plaintiff and others of defendant's competitors its valuable, though intangible property, without a shadow of right in the plaintiff. This amounts to the taking of property without due process of law, and also to the taking of private property for private use.

To grant this motion would enable anyone to purchase a patent for perhaps a nominal price and by suing a competitor for infringement obtain a key that would unlock the competitor's factory and records and drawings to the suitor who could by this unlawful inquisition gather into his Abraham-like bosom all of the intangible property of the competitor. This statement is believed to be its own answer.

It is submitted that the motion should be dismissed.

HUGH M. MORRIS,
A. F. KWIS,
AUGUSTUS B. STOUGHTON,
for Defendant.

STATE OF PENNSYLVANIA }
COUNTY OF PHILADELPHIA } *ss.*

John R. Williams, being duly sworn according to law deposes and says:

"I am of mature age and have since the 15th day of May, 1928, been President of the defendant Company, and prior to that time for twenty-eight years I was Vice-President of the defendant Company. I have read the paper entitled "Answer to Motion" in this case, and I understand the same, and the facts set forth in said Motion are true, to the best of my knowledge and belief.

The U-S-L Battery Company is a large manufacturer of storage batteries and competes with the Defendant in the storage battery business. The companies named in Paragraph 19 in the Bill of Complaint, except the Northeastern Engineering Corporation, are affiliated with the U-S-L Battery Corpora-

tion. The Defendant has been engaged continuously in the battery business since 1888, and during that entire time has always applied itself to manufacturing storage batteries of the highest attainable standard of quality, and maintains a chemical and electrical laboratory employing a staff of highly trained chemists and engineers to the end that the manufacturing is conducted in a very efficient manner. Under the direction, or with the cooperation of, this large and capable technical staff, the layout of the plant, the machinery and methods employed, and the technique of the manufacturing operations have been developed and improved and made efficient to a high degree of specialization adapted to produce a high class product. The set-up and arrangement of the Defendant's plant is an exceedingly valuable asset in that it reduces or minimizes the cost and insures uniformity of product. These methods and arrangements have resulted from a very large expenditure of money as well as the application of unusual abilities and are of great value to the defendant who submits that no competitors of the Company should be given access to or by inspection obtain the benefit of this time and work and expense and thus cause the Defendant a very substantial injury and loss. Since 1895 and for a very substantial consideration the Defendant has had an agreement with the Accumulatoren-Fabrik Aktiengesellschaft, a German corporation, the largest manufacturers of storage batteries in Continental Europe, whereby engineering and technical information and new developments are exchanged between the two companies.

I have met Mr. C. Reed Cary, of Philadelphia, Pennsylvania, but know him very slightly. He is now and for some years last past has been a officer of Leeds and Northrup Company, of Philadelphia. Mr.

Cary is not now and never has been employed by the Defendant in any capacity whatever. In 1926 Mr. Cary, entirely on his own motion, and as he said at the request of Plaintiff, brought to the attention of the Defendant a sample of lead oxide powder, which Mr. Cary said had been given him by the Plaintiff with the request that he deliver it to the Defendant.

At this time, being the first time the Affiant ever met Mr. Cary, the Defendant Company was and had been successfully manufacturing lead oxide powder by the Hall process in a commercial way and in large amounts, and Defendant's interest in the Shimadzu sample was only general and such as Defendant would have in connection with any product useful, or said to be useful, in its business. In his efforts to interest the Defendant in the Shimadzu patents, one Mr. Ishimura, representing himself as an agent of Shimadzu, submitted Shimadzu's patents along with a proposed form of contract to the Defendant. The Defendant was advised by its counsel that the Shimadzu patents were not valid, and by its technical staff that the process and product of Shimadzu disclosed nothing of value over what was already known and in practice and in commercial use by the Defendant. For these reasons the Defendant dropped the negotiations. One of the reasons for the opinion expressed by counsel to the effect that the Shimadzu patents were invalid, was the early and successful work done by the Defendant, and it was in view of that early work that, under the advice of counsel, the Defendant instituted interference proceedings.

JOHN R. WILLIAMS.

Sworn to and subscribed before me this 18th day of December, A. D. 1933.

WM. C. DUBOIS,
(Seal) *Notary Public.*

STATE OF PENNSYLVANIA }
COUNTY OF PHILADELPHIA } ss:

Edward Wanton Smith, being duly sworn, according to law, deposes and says:

"I am a graduate in Chemical Engineering, of the University of Pennsylvania, and have practiced my profession for thirty-five years. I am the Manager of the Development and Design Division of the Defendant, and for many years was Factory Engineer for this Company.

From the beginning of the use of lead oxide powder by the Defendant, I have been intimately familiar with its production, with the machinery and equipment for producing it, and with the manufacture of plates made from it.

In the Summer of 1907, at the works of the Accumulatoren-Fabrik Aktiengesellschaft in Hagen, Germany, my attention was first directed to the manufacture of lead oxide powder for use in the manufacture of storage battery plates, in a rotating mill containing lumps of lead, and which was supplied with air, and from which the lead oxide powder was discharged through perforations in the wall of the mill. At that time such manufacture of lead oxide powder was not commercially known in the United States.

I arranged for the importation from Germany of, not only samples of the lead oxide powder, but also storage battery plates pasted with it. These were received in 1908 and 1909 in this country. They were tested and were so promising that in 1912 and 1913 I again visited the plant of the Accumulatoren Fabrik Aktiengesellschaft and obtained full details of the process and of the employment of the resulting lead oxide powder in storage battery plates.

The information acquired in Germany, corrobo-

rated by our own investigations was so satisfactory that in 1915 I put up for the Defendant in Philadelphia a mill which was completed in 1916 and operated, and a large number of plates were made from the resulting lead oxide powder.

These plates were so successful that twenty storage batteries containing them were sold to the New York Railways Company and put into operation. Their operation was so satisfactory that in 1918 a second lot of batteries, made from this lead oxide powder, and amounting with the first-mentioned batteries to 19,000 plates, was furnished to the same Company.

In 1920 Defendant engaged Clarence A. Hall, and he, under my supervision, introduced as an improvement on the German mill, a Hardinge mill of standard size. Under my supervision and general direction, with this and other like Hardinge mills since 1921, the Defendant has produced lead oxide powder to the extent of many million pounds. The lead oxide powder produced in the replica of the German mill and in the Hardinge mills was and is identical in all substantial and material respects, although with the Hardinge mill the powder was somewhat finer.

In or about May 1926 Mr. C. Reed Cary submitted to me a sample of lead oxide powder which he said was obtained from the Plaintiff and which was marked with Plaintiffs' name. From a careful examination of the sample of lead oxide powder submitted by Mr. Cary and from his meager description of the method of manufacture, and from a description of it given by Mr. Ishimura, I was then convinced that there was nothing new of value in the lead oxide powder and processes which Shimadzu was promoting.

In the course of his work in the making of lead

oxide powder in the Hardinge mills, Hall made some satisfactory experiments on its use as a paint. This was all prior to the year 1926 and the Defendant has never sold any paint of this kind or made it on a commercial scale.

EDWARD WANTON SMITH.

Sworn to and subscribed before me this 18 day of December 1933.

WM. C. DUBOIS.
(Seal) *Notary Public.*

STATE OF PENNSYLVANIA }
COUNTY OF PHILADELPHIA } *ss:*

Clarence A. Hall, being duly sworn according to law, deposes and says:

"I am a chemist and graduated in 1896 as such from the University of Pennsylvania. In July of 1920 I was employed by the Defendant to direct the design, installation and operation of a larger plant for the manufacture of lead oxide powder in continuation of the work previously done by the Defendant. I designed and installed a new plant and have directed its operation up to the present time.

Prior to my employment with the Defendant, I know that it had manufactured lead oxide powder in a replica of a German mill, and in continuation of that manufacture I introduced the use of Hardinge mills. With the Hardinge mill I had successfully produced large quantities, amounting to millions of pounds of lead oxide powder, before I ever heard of Shimadzu, and when I learned in April 1924 that Shimadzu had entered the field and (later) saw a sample of lead

oxide powder which I was told was his product, I was of the opinion that some of the product I had made corresponded with Shimadzu's sample. In this belief I instituted interference proceedings in the Patent Office to the end that no one else should enjoy patent rights for what I then considered to be my invention. It subsequently developed that in view of the prior art and of what had previously been done by the Defendant, the scope of my invention was somewhat curtailed. The fact is that prior to the time that I ever heard of Shimadzu or of any of his work and prior to the date of filing of any of Shimadzu's applications for the United States patents in suit, the Defendant was producing commercially and under my direction large quantities of the identical lead oxide powder which the defendant is today manufacturing, still under my direction.

Since 1921 to the present day the lead oxide powder manufactured by the Defendant and commercially used in the manufacture of storage battery plates has been continuously analyzed and carefully tested for its chemical and physical property and I have recently examined the records of those tests and analyses which are on file at the Defendant's office, and these records show, and I know it to be a fact, that the lead oxide powder manufactured by the Defendant and used in storage battery plates is the same now as it was in the beginning and has been the same throughout the entire period of manufacture. Furthermore the process has never been changed in the manufacture of lead oxide powder for use in storage battery plates from the beginning of 1921 to the present time and during all that time a Hardinge mill has been exclusively employed.

CLARENCE A. HALL.

Sworn to and subscribed before me this 18 day of December 1933.

WM. C. DUBOIS,
(Seal) *Notary Public.*

STATE OF PENNSYLVANIA }
COUNTY OF PHILADELPHIA } *ss:*

Joseph Lester Woodbridge, being duly sworn according to law, deposes and says, "I am a graduate in mechanical engineering of the Stevens Institute of Technology, and I am a doctor of engineering of the same institution. For many years last past I have been in the employ of the defendant as chief engineer and I have been frequently called upon to compare the subjects matter of patents and written descriptions, both in patent litigations in the courts and in the procuring of patent applications in the Patent Office and in the consideration of patents generally. I have made myself familiar with and I believe that I understand the various oxides of lead and also their manufacture and I am familiar with their use in storage battery plates.

I have read and I believe that I understand United States patents Nos. 1,584,479, 1,584,149 and 1,584,150 all granted to Shimadzu, and I know that Shimadzu is the plaintiff in this case. I have also read and I believe that I understand translations of Japanese patents Nos. 42,861, 42,728 and 42,563. These translations were, I am advised and believe, prepared under the direction of Langner, Parry, Card and Langner, International patent and trademark solicitors and agents of New York by Mr. Olpin a

doctor of science of Columbia University who has resided for a number of years in Japan and is familiar with the language of that country, with the assistance of a Japanese whose name I do not know and I believe that these translations are correct. I have also read, and I believe that I understand, British patent No. 197,031 to Shimadzu.

The subject matter described and referred to in the claims of letters patent No. 1,584,149 and 1,584,150 and in my opinion the process and product described in these two United States patents are identical, notwithstanding that in United States patent 1,584,149 the product is called reactive lead powder, and in United States patent 1,584,150 the product is called a powder of lead suboxide intermingled with powder of metallic lead. In both of these U. S. patents, the process comprises rumbling pieces of metallic lead in a revolving drum in the presence of air, whereby, by the abrasion of the lumps of lead a very fine reactive leaden powder is produced. In United States patent 1,584,150 a temperature between 60° and 200° C. is mentioned. In U. S. patent 1,584,149 no mention is made of temperature in the process, but in my opinion, as a result of the process described, the elevated temperature within the limits specified in U. S. patent 1,584,150 would unquestionably arise. The product described in both of these U. S. patents is identical as to its chemical reactivity and its physical characteristics. In U. S. patent 1,584,149 the claims are directed to a process of forming a finely divided chemically reactive lead powder. In U. S. patent 1,584,150 some of the claims are directed to a process for producing a mixture of lead and lead oxide without specifying any particular oxide; other claims are directed to a process and product in which lead sub-oxide is specified.

Japanese Patent No. 41,728 discloses the process consisting in placing pieces of metallic lead in a rotating vessel, rotating the vessel and grinding them to bits by means of the frictional rubbing of the lumps of lead on one another. The product is described as a highly reactive lead powder of very fine particles. Lead sub-oxide is not specifically mentioned in the patent. Reference is made to spontaneous combustion (oxidation) of the powder in the drum, which involves the presence of air in the drum and to elevated temperature sometimes making it necessary to dissipate the heat of friction.

Japanese Patent 42,563, is an improvement on Japanese Patent 41,728, in which a blast of air is introduced into the process for blowing the product out of the mill. Lead suboxide is not specifically referred to, although oxidation of the product in the mill is disclosed.

British Patent 197,031 to Shimadzu describes a product as a reactive lead powder and a process of producing a fine chemically reactive lead powder, consisting of tumbling pieces of lead in a rotating drum and supplying a blast of air inside the drum, whereby the lead balls are abraded and pulverized into a very fine powder, which is blown out of the cylinder by means of the air blast. On page 2, lines 25 to 32, reference is made to lead suboxide and in my opinion the meaning is, that the product becomes in part lead suboxide.

The application on which United States Patent 1,584,149 issued was made January 30, 1922 and the application on which 1,584,150 issued was made July 14, 1923, Japanese patent 41,728 issued February 13, 1922 on an application filed November 21, 1920 and Japanese patent 42,563 issued May 10, 1922 on an application filed November 27, 1920. Therefore the Japanese pat-

ents issued before the United States patents and the applications on which the United States patents issued were filed more than one year after filing of the applications on which the Japanese patents issued. British patent 197,031 was accepted May 7, 1923, and in the usual course was sealed shortly thereafter, and the application for it was filed February 2, 1922, and in my opinion the British patent was issued before both these U. S. patents were issued and on an application filed more than a year before the application on which American Patent No. 1,584,150 was issued. In my opinion British Patent 197,031 refers to the product in terms which clearly indicate that it was described as lead suboxide, although lead suboxide was not referred to in its claim. I am advised and believe that the omission to claim lead suboxide in the British patent had the effect to abandon that product to the public in the United States. In my opinion, the subject matter of the United States patents and that of the Japanese patents are in all substantial and material respects identical, although in the Japanese patents lead suboxide is not named. In my opinion the invention described in the British patent and in the United States patent 1,564,150 are substantially the same, including the specification of lead sub-oxide.

The United States letters patent No. 1584479, issued May 11, 1926 on application filed February 20, 1923, and Japanese patent No. 42,861, issued on June 17, 1922 on application filed August 3, 1921, hence the United States patent issued after the Japanese patent on an application filed more than one year later than the application on which the Japanese patent issued. Both of these patents describe the manufacture of storage battery plates from a paste made from the highly reactive lead oxide powder of apparent specific gravity less than 3.0, resulting from the abrasion of

lumps of metallic lead. While the Japanese patent does not specifically refer to sub-oxide of lead as the oxide used in making the plate, the British patent which issued before the United States patent on an application filed more than a year before the application for the United States patent, discloses as Shimadzu's invention the product lead sub-oxide, and by not claiming it abandons it in the United States to the public. In my opinion, and in view of the abandonment of lead sub-oxide to the public in the United States, the Japanese patent issued for substantially the same invention as the United States patent.

JOSEPH LESTER WOODBRIDGE.

Sworn to and subscribed before me this 18th day of December, 1933.

WM. C. DUBOIS,
(Seal) *Notary Public.*

STATE OF PENNSYLVANIA)
COUNTY OF PHILADELPHIA) *ss:*

C. Reed Cary, being duly affirmed, deposes and says:

I have never represented the Electric Storage Battery Company in any capacity whatever. In 1926, while in Japan on business for my company, I became acquainted with Mr. Shimadzu. Mr. Shimadzu told me that he was interested in the development of a process for the production of finely divided lead for storage batteries. He asked me if I was acquainted with any of the manufacturers of storage batteries in the

United States. I informed him that I was personally acquainted with one of the leading engineers of the Electric Storage Battery Company and he inquired whether I would be willing to show my friend some of their material and gave me a sample of the product. He then took me for a drive around the city, and stopped at a factory in which he was interested and which was engaged in manufacturing storage battery material. My visit lasted but a comparatively few minutes and he casually showed me a plant in which some machines were producing the powder in question. I had no particular interest in the matter and the above states all that I learned about the manufacturing process.

All that I saw was a chopper cutting lead bars into chunks, which went out of sight and when it reappeared was in the form of a fine powder. This represents the full extent of the knowledge I acquired concerning their processes.

After this visit I had no further occasion to meet Mr. Shimadzu, but on my return to this country a few months later I delivered the sample as requested and told Mr. E. W. Smith that my Japanese friends wished them to look into the merits of their process and product, and delivered to him the sample, after which I considered my mission completely fulfilled.

(sgd.) C. Reed Cary.

Affirmed and subscribed before me this 14th day of December, 1933.

(Illegible)
(Seal) *Notary Public.*

STATE OF PENNSYLVANIA }
COUNTY OF PHILADELPHIA } ss:

Edward W. Smith, being duly sworn according to law deposes and says that the Defendant has never practiced the process described in patent No. 1,584,-151, and has never oxidized lead suboxide to litharge or other higher oxide which is the product of that process.

Sworn to and subscribed to before me this 19th day of December, 1933.

EDWARD W. SMITH.

My Commission expires April 4, 1935.

EVERETT S. RODEBAUGH,
Notary Public.

DEFENDANT'S MEMORANDUM IN OPPOSITION TO PLAINTIFFS' MOTION TO INSPECT DEFENDANT'S PLANT.

At the argument defendant offered to submit authorities dealing with plaintiffs' right to inspect defendant's plant under the facts set up in defendant's answer to plaintiffs' motion.

Substantially all the cases found upon this matter follow:

Walker on Patents, Sec. 672, says:

> "Mere suspicion of infringement is not sufficient to justify the issuance of an order for inspection."

In the case of Dobson v. Graham, 49 Fed. 17 (Pa.)

plaintiff moved for inspection of defendant's machinery. Judge Butler dismissed the motion saying:

> "* * * the plaintiff filed his bill charging infringement of his rights without having any positive knowledge upon the subject. He seems to have relied upon the chance of obtaining evidence to support the charge from the defendant and his workmen. Such a case is not entitled to the special favor of a court of equity. The defendant's business is conducted in private, for the purpose of securing to himself (as he asserts) the use of his peculiar machinery and methods of manufacture. These secrets of his business, if they cover nothing unlawful, are his property and as well entitled to protection as the rights secured by the plaintiff's patent. His workmen are bound by express contract not to divulge them. In the absence of such contract equity would imply an obligation of equal force. If it were shown that these secrets are used as a cloak to cover an invasion of the plaintiff's rights, or if there was reliable evidence tending to show it, and justifying a belief that they are sound, the motions would be sustained. But there is no such evidence before us. It appears that the defendant employs certain workmen who were formerly employed by the plaintiff; that these workmen are familiar with the plaintiff's patented machinery, and that they aided in constructing the defendants. This is substantially all. These workmen have been permitted to answer questions directed towards a comparison of the defendant's machinery with the plaintiff's except where the answer would tend to describe wherein the former differed from the latter, and thus to describe the peculiarities of the defendant's machinery. The court cannot properly compel them to go further, nor, in this state of facts, compel the defendant to submit his machinery to inspection."

Eibel Process Co. v. Remington-Martin Co., 197

Fed. 760, is a suit on motion for inspection of defendant's alleged infringing machines and to compel defendant to furnish samples of its product. Judge Ray denied the motion, saying:

> "I am not called upon to express any opinion as to the defense of prior use, etc., the antiquity of the idea expressed in the patent. The defendant has not had opportunity to cross-examine the persons whose affidavits are presented on this motion, and, if their testimony is taken, it may not cross-examine or controvert anything they testify to. By testimony taken in the case the complainant has not made a prima facie case of infringement. It does not as yet appear that there will be any dispute or controversy as to the elevation of the breast-roll end of defendant's screens, or their length.
>
> "The composition used by defendant in making its paper is no concern of the complainant at this stage of the case, and so far as appears, defendant's product is on the market. I think the motion premature. It is a serious thing to direct a manufacturing corporation to allow the attorney and agents and experts of a rival concern to enter its plant and inspect and measure its machinery and the operation thereof and compel it to furnish samples of its stock and product. 'Suspicion' of infringement is not enough to justify such an order as is asked for, and I decline to follow Rowell v. William Koehl Co. (D. C.) 194 Fed. 446, 447, where it is indicated that 'suspicion of infringement' will justify an order of inspection. A prima facie case made by taking testimony and concealment by defendant of its alleged infringing devices, or of plans, drawings, and documents would justify such inspection. This is the doctrine of Dobson v. Graham (C. C.) 49 Fed. 17, and Diamond Match Co. v. Oshkosh Match Works et al (C. C.) 63 Fed. 984, 985. In Diamond Match Co. v. Oshkosh, etc., supra, the court said:

> 'The complainant is not entitled to the aid of the court, upon the suspicion or an allegation of infringement, to pry into the business operations or appliances of the defendants, either to the end of making out a case against them, or for any other object. The defendants are entitled to protection in their rights and property, and will not be required to make premature disclosures of their matters of defense.'

"And in Dobson v. Graham, supra, the court said:

> 'Complainant will not be granted an inspection of machinery of defendant kept in secret, and claimed to embody important secrets, when complainant produces no evidence tending to show that it infringes his patents.'
>
> "* * * I do not think such an order as is asked for here should be granted an affidavit made prior to the taking of testimony in the case, except possibly in exceptional cases of which this is not one. As at present advised, I see no reason whatever for ordering the production or examination of defendant's stock or product.
>
> "The motion is denied * * *."

The case of *Stokes Bros. Mfg. Co. v. Heller*, 56 Fed. 298 (N. J.) was heard on complainant's motion for an order that defendants permit an inspection of their factory. Judge Green denied the motion saying:

> "They (the complainants) now move the court to order that the defendants do permit a ful and thorough inspection of their manufactory, situate in Newark, N. J., and all of their machinery, and of all their processes for the manufacture of the rasps or files made by them, and which files and rasps, and processes and machines, the complainants allege, infringe their letters patent. The defendants, in their answer, deny infringement, and furthermore assert, under oath, that rasps have been manufactured by them, by a peculiar

process, not patented, but kept as a secret in their business, since 1836; and they produce files and rasps before the court, which, as shown by affidavits uncontradicted, were made many years before the letters patent in question were issued, and which to the eye, at least, seem to be entirely similar to those now made by the complainants. Under these circumstances, to compel the defendants to open their manufactory to hostile inspection of rivals in business, and to disclose the character of the machines and the process by which for so many years they have made a successful article of merchandise, would be unjust and inequitable. The motion is too obviously the excuse for a 'fishing excursion', and does not, under the circumstances of this case, commend itself to the court."

In *Germ Milling Co. Ltd. v. Robinson*, 1 T. L. R. 38, 1 R. P. C. 217 (1884) the plaintiffs were the proprietors of the patent of a machine for "improvement in the manufacture of meal and flour from wheat etc.", which they alleged had been infringed by the defendant. The plaintiffs now sought to obtain inspection of the defendant's machinery, which was resisted, upon the grounds: (1) That the plaintiff's specification was too vague; and (2) that no sufficient particulars had been given by the plaintiffs of the acts of the defendants which were alleged to constitute a breach of plaintiffs' patent. Held that all the plaintiffs showed was that they suspected an infringement on the part of the defendant, and that, inasmuch as the particulars of breaches were described in too general words, it was not a case in which the court would order inspection. The request to inspect was by motion. The court, speaking through Mr. Justice Kay, on page 219 said:

"The reason for which I think it is not proper

to grant an inspection at this moment is this, that the patent, as stated shortly, seems to me to be a patent for a rather elaborate process of manufacturing meal and flour * * * I do not wish to give the least opinion upon the matter one way or the other now, but it may be that every single process of that may be old, and yet the whole process, by being combined in a new way to that in which it has ever been used before, or for other reasons, may be a perfectly good subject of a patent. On that I do not mean to give an opinion one way or the other, but the plaintiff in this case has stated that the defendants have infringed, and the only particular of breaches he gives is this: 'Since the date of the assignment the defendants have manufactured, and they continue to manufacture, meal and flour from wheat and other grain by a process identical with, or substantially similar to, that described in the specification'. Of course this is not a particular at all. It is as general a statement as you could put into words; and to call that a particular of breaches seemed to me to be a contradiction in terms. Then in the affidavits, no doubt, as Mr. Ashton has pointed out, the plaintiff does say something a little more definite. He says in the fifth paragraph, 'The defendants are extensive corn millers at Greenwich, and they have recently introduced therein machinery for reducing wheat into flour by means of rolling and sifting, and I verily believe that the defendants are now manufacturing wheat into flour by means of my said invention, and by the process or means described in my said specification, or only colourably differing therefrom'. The first thing I have to consider is, what sort of evidence is that? There is a rule in this Court, that where a person states, as he may in an affidavit upon an interlocutory motion, his belief, of a fact, he must state the grounds of that belief. What are the grounds for that belief? There are absolutely none; I mean there are none stated. That means, this, then: 'I suspect', (be-

cause 'I believe' without any grounds is only 'I suspect') 'that the defendants are manufacturing according to my process.'' Thereupon, without any particular, without any evidence which the court ought to look at as being evidence of infringement, I mean even the most *prima facie* evidence of infringement, the plaintiff comes to the court and says, 'Grant me inspection'. The defendant's answer in effect, because I am not giving the words, is, 'I have a great many processes in my mill which are trade secrets, which I do not want people to inspect'. That is a very good answer unless the plaintiff makes out a strong ground for inspection, but in point of fact the whole of this pleading and evidence before me now amounts only to this: for some reason, which is not expressed, I, the plaintiff, say, 'I suspect the defendants are infringing this elaborate process of mine,' if he had said, 'The nature of the flour they produce is such that it could not have been done by any other process', and satisfied the court to that, that would be one thing * * *. But he says nothing of the kind, and this is really no more than this, taking the pleadings and affidavits, and every thing which are before me, 'I suspect and I will not tell you my grounds for suspecting, that the defendant is infringing this elaborate process of mine, and I ask for leave to go and look into his works to see whether I can make a case against him or not'. That is not the way in which the Court can grant inspection, and therefore at present I decline to make any order on the motion."

In *Chbetham v. Oldham & Fogg*, 5 R. P. C. 617 (1888), the plaintiff, as patentee of an invention for "improvements in the manufacture of felt hats, caps and other head coverings, and in the apparatus employed in such manufacture" commenced an action against defendants for infringement, and moved for

an inspection of defendant's processes, apparatus and machinery. The Court held (b) that a prima facie case of infringement will support a claim for inspection by a plaintiff (c) that inspection must be limited to those of the defendant's processes as to which a prima facie case of infringement has been made out, and as the plaintiff's evidence as to all the defendant's processes, except one, amounted only to suspicion on his part that they constituted infringements without the ground of such suspicion being stated, inspection must be limited to such one process. The inspection was asked for in this case by motion. Bristow, V. C. says at page 620:

> "* * *; but I think inspection in matters of this kind must be kept within some limit, and that a roving inspection cannot be a right thing to order, except upon reasonably clear evidence that the inspection sought, whether of a process or a mode of manufacture, or the uses of machinery as the case may be, is really required for testing the alleged infringement."

Again at page 621:

> "Now, then, I have to think what is the inspection to which they are entitled. In my judgment it must come to this:—there must be an inspection of all that is sufficiently proved at the present moment to be a prima facie case of infringement, absolute infringement not, but a prima facie case of infringement. But to carry it beyond that I do not think I ought to make an order for inspection. * * * I think, following the view taken by Mr. Justice Kay in the case of the Germ Milling Co., 1 R. P. C. 217, I ought not to grant inspection generally over the defendant's premises, the final statement in evidence being merely that 'it may probably be' that the defendants adopt other processes which are infringements."

McDougall v. Partington, 7 R. C. 351 (1890) was an action to enforce the performance of a contract, providing that the parties were to share all information and discoveries, the parties were to be allowed to inspect each others works. Any patents obtained during the period were to be vested in plaintiffs and the defendant was entitled to work them under a license at a royalty. Plaintiffs claim specific performance claiming that defendant had made and was using certain improvements of which he had not given them information; that he (defendant) would allow them to inspect his works etc. The defendant attacked the contract on fraud, misrepresentation, abandonment and other grounds. He also denied that he was using any process that came within the terms of the contract. The plaintiffs applied for inspection of the defendant's works. This was resisted on the grounds that, for the purpose of preparing for the trial of the action, no such inspection was necessary. Held, that inspection must be refused. Vice-Chancellor Bristowe said at page 356:

> "* * * It is obvious that that is a very large demand on the part of the plaintiffs—that they may be at liberty by themselves, their counsel and solicitors in the usual way to enter into the whole business premises and works of the defendants, 'and examine the whole of the processes there used and practiced in the formation of wood or paper pulp' in the manner referred to—to make experiments, to take samples, and to require the processes to be worked for their purposes. In the outset, I think it is right to state that in my view of the authorities on the subject, apart from this particular case, the right in a case of this kind to inspection is not so high as it has been put. I do not think (and having regard to the authorities, I think that the proposition I am about to lay down is a true one) that there is an absolute right on the part of a person, suing as the plaintiff sues

here, to inspection without anything more than merely saying, 'I desire inspection, and therefore I will have it'. I think it is not such a matter of right."

The Vice-Chancellor then reviews all the early decisions and says (page 356):

"You cannot, in my judgment, read those judgments without coming to the conclusion that the Court of Exchequer held at that time that it was not a matter of right. Those cases remain pretty much as they were."

Continuing on page 357:

"It is not a case of absolute right, but it is a case of showing that the Court ought, in the exercise of its discretion, to make the order for inspection. I think also that you cannot look at the decisions of V. C. Bacon in Batley v. Kynoch without coming to the same conclusion, namely, that there must be no inspection, unless it was absolutely essential to the plaintiff's case * * * It seems to me that it is carefully guarded, that the right of inspection is a right to be given at the discretion of the court—to be exercised with a judicial discretion and with due regard to the interests of the parties concerned in the litigation."

In conclusion at page 360, the Court said:

"Bearing in mind the great difficulty and the serious loss and injury which might be caused to the defendant by an inspection; and the, to my mind, comparatively little use, if any use at all, to the plaintiff, I come to the conclusion that there is no case here, in which the Court, exercising, as I think it is bound to exercise, judicial discretion, ought to make any further order for inspection. Refused."

In *Batley v. Kynoch*, 44 Law Journal Reports

(Chancery) 89 (1875), plaintiffs in a suit for the infringement of a patent held by them for the manufacture of certain cartridges applied by motion for an inspection of the machinery and premises of the defendants, who were also large cartridge manufacturers. Defendants alleged by affidavits that the inspection was only asked for to enable plaintiffs to see their machinery, and they believed it to be unnecessary for purposes of the suit:—Held that as there was no allegation by the plaintiffs that such inspection was necessary, and as there was an allegation by the defendants that it was not necessary, the motion must be refused. Bacon, V. C. at page 90 said:

> "There can be no doubt that in such a suit as the present the plaintiff has a right to any evidence which may be necessary to enable him to prove the infringement which he alleges. In this case, however, the plaintiff has made no allegation by affidavit or otherwise that the inspection he asks for is necessary for the purposes of the suit, and the defendants, on the contrary, have made a distinct allegation that the inspection is unnecessary. * * * The motion for inspection must therefore be refused."

PLAINTIFFS HAVE SHOWN NO PRIMA FACIE CASE OF INFRINGEMENT.

Defendant has shown on page 4 of its answer to plaintiffs' motion for inspection that:

> "The product made by the Defendant in 1921, is the same as the product made by it at the present time, and the process and apparatus employed are identical."

In *Hall vs. Shimadzu*, 59 Fed. (2d) 225, 226, the Court of Customs and Patent Appeals said:

> "While the preliminary statement of appellee

alleged conception and reduction to practice prior to his filing date of July 15, 1923, both the Examiner of Interferences and the Board of Appeals held him to said filing date for both conception and reduction to practice. In view of the conclusions we have reached, it is unnecessary to examine the action of the Patent Office tribunals on this point."

It follows that since defendant's product and process are the same now as in 1921 they cannot now infringe plaintiffs' claims for the prior use in 1921 would invalidate those claims, if the product and process fall within them.

In the Patent Office defendant contended that its product and process were the product and process of the counts in interference. This the Patent Office tribunals and the Court of Customs and Patent Appeals denied, and were urged so to do by the plaintiff, Shimadzu.

There is no scintilla of evidence that the product and process of defendant here are not the same as they have been since 1921.

MOREOVER, DEFENDANT HAS HERE DISCLOSED WHAT ITS PROCESS AND PRODUCT ARE.

On page 4 of its answer to plaintiffs' motion defendant has said:

> "The mill so employed in 1921 is illustrated and described in patent No. 1,675,345, and the process and product are described in patent No. 1,888,823, both to C. A. Hall."

The information contained in these two Hall patents is necessarily sufficiently full and clear not only to enable anyone to understand the machine, process and

product but also to practice the process, make and use the machine, and produce the product. Section 4888 of the R. S. provides that before an inventor shall receive a patent for his invention or discovery he "shall file in the Patent Office a written description of the same, and of the manner and process of making, constructing, compounding and using it, IN SUCH FULL, CLEAR, CONCISE AND EXACT TERMS AS TO ENABLE ANY PERSON SKILLED IN THE ART OR SCIENCE TO WHICH IT APPERTAINS, OR WITH WHICH IT IS MOST NEARLY CONNECTED, TO MAKE, CONSTRUCT, COMPOUND, AND USE THE SAME; AND IN THE CASE OF A MACHINE, HE SHALL EXPLAIN THE PRINCIPLE THEREOF, AND THE BEST MODE IN WHICH HE HAS CONTEMPLATED APPLYING THAT PRINCIPLE * * *." The presumption is that the Patent Office required Hall to comply with the provisions of the Statute. It appears that Plaintiff is already in possession of a full, clear, concise description in exact terms such as enables any person not only to understand what defendant is doing but also to practice the inventions that defendant is using. With such information in hand plaintiff, if acting in good faith, ought to know whether or not, in plaintiff's opinion, defendant is infringing.

At the argument the plaintiff in connection with its patent 1,584,150, sought to carry its effective date back of its filing date, July 14, 1923, by reference to the first paragraph in the description. Plaintiff unsuccessfully made that same contention in the suit in substance between the same parties as the present suit, which was decided by the United States Court of Customs and Patent Appeals. In 59 Fed. Rep. (2nd), page 226, the Court of Customs and Patent Appeals said, "While the preliminary statement of appellee

(Shimadzu) alleged conception and reduction to practice prior to his filing date of July 14, 1923, both the Examiner of Interferences and the Board of Appeals held him to said filing date for both conception and reduction to practice." The Court of Appeals stated that in view of its conclusions it was unnecessary for it to examine the action of the Patent Office tribunals on this point. On page 215 of the Transcript of Record in the decision of the Board of Appeals the following appears:

> "Shimadzu is involved upon his patent, 1,584,150, of May 11, 1926, filed July 14, 1923, and it appears from the Record that he is confined to that date."

CONCLUSION.

It follows that plaintiffs have not only failed to make out a prima facie case of infringement but that unless the conclusion of the Patent Office tribunals made at the insistence of Shimadzu is to be overruled on this motion at the instance of Shimadzu, it is obvious that defendant is not infringing any valid claim of Shimadzu's patent.

Moreover, it appears that plaintiffs have under the Hall patent above referred to, all the information to which they would be entitled had they made out a prima facie case of infringement.

Plaintiffs' motion should be denied.

Respectfully submitted,
HUGH M. MORRIS,
AUGUSTUS B. STOUGHTON,
A. F. KWIS,
E. S. W. FARNUM, JR.

DEFENDANT'S SUPPLEMENTAL MEMORANDUM IN REPLY TO PLAINTIFFS' MEMORANDUM AND SUPPLEMENTAL MEMORANDUM IN SUPPORT OF PLAINTIFFS' MOTION FOR INSPECTION.

PROCEEDINGS IN THE PATENT OFFICE.

The parties to this infringement suit are the same as the parties to the interference Hall vs. Shimadzu decided by the Court of Customs and Patent Appeals, 59 Fed. (2nd) 225.

In the interference proceeding the subject matter involved was limited to lead suboxide as claimed in Plaintiffs' Patent No. 1,584,150, here in suit and more particularly referred to by Plaintiff.

From Plaintiffs' Supplemental Memorandum, page 14, and elsewhere, it appears that Plaintiff is seeking inspection of an unusually searching character and of the widest latitude in respect to lead suboxide.

The Court of Customs and Patent Appeals held 59 Fed. (2nd) 227, "that the phrase here under consideration (a process of manufacturing a fine powder of lead suboxide intermingled with powder of lead appearing in the claims or counts) is more than merely an introductory phrase, and is absolutely essential to point out the invention that is here involved."

Hall introduced evidence showing all the facts of his invention and excerpts from it are given in Plaintiff's Supplemental Brief. These excerpts indicate that Hall and his witnesses believed and stated and were of opinion that the powder which they made from the beginning contained suboxide of lead. Shimadzu introduced evidence of which the following sample was

given by S. Ishimura who had been engaged in business with Shimadzu from 1906 to 1908, and from 1917 to date.

We quote from page 129 of the record in the interference case:

> "Q. 31. Was the apparatus that you used identically the same as that shown in Hall patent application, and was the process carried out identically the same as the specification requires?
>
> A. I think so, because we used a Hardinge type of six feet standard mill.
>
> Q. 32. Mr. Ishimura, were you able to get any suboxide of lead in your experiments with what you say was a duplication of the Hall apparatus and a duplication of the Hall process as described in his specification—could you get any suboxide of lead?
>
> A. I do not think I can get any suboxide."

The same witness at page 475, says:

> Q. 36. Mr. Ishimura, what was the color of the product that you obtained in the Depew test from the Hardinge mill?
>
> A. Yellowish sort of gray.
>
> Q. 37. What is the color of the powder that you get by following the Shimadzu process?
>
> A. Black. That is, if you describe the substance of lead suboxide, that is a definite chemical compound having certain chemical properties, and also physical properties, that include and specify definitely the color of the product, which is supposed to be black.

At page 525, Shimadzu's witness, Harold M. Wood, an expert chemist, says:

> Q. 45. In your experience in the manufacture of this powder, what would be the characteristics of the powder obtained from the Shimadzu ma-

chine as compared with the powder obtained from the Hardinge machine?

A. A powder obtained from the Shimadzu machine contains a major portion of lead suboxide, *whereas the powder obtained from the Hall machine contains no lead suboxide.* The powder from the Shimadzu machine is black in color, whereas the powder from the Hall machine is olive-gray in color. The powder from the Shimadzu machine when touched with a match, will oxidize rapidly in the atmosphere, the reaction spreading throughout the mass of the powder. This is not true of the powder obtained from the Hall machine. (Emphasis supplied.)

The testimony quoted by plaintiff's attorney from the interference case, if it be construed to apply to defendant's lead oxide powder produced after the date of Shimadzu's patent, merely confirms defendant's assertion that his product has been the same both before and after that date.

While briefs of counsel are not parts of the record some light may be shed on Plaintiff's position in the interference proceedings by referring to extracts from the briefs filed by Plaintiff in the Patent Office proceedings.

In the brief for Shimadzu before the U. S. Court of Customs and Patent Appeals, pages 12 and 13, the following statement appears:

"What gives life to all the counts in both these interferences is the inclusion therein of the 'suboxide of lead' in interference 54,798 and the more specific counts specifying the proportions of suboxide and pure lead in 56,224. That is all that renders the counts patentable over the Bailey patents 846,384 and 846,444 discussed in the Interference Examiner's decision in interference 54,798 and in Mr. Hall's deposition pp. 64 to 67. (Rec. p. 320) in interference 56,224. Hall's right to in-

clude this lead suboxide powder in his claims was the storm center of interference 54,798. That identical point was the crux of interference 56,224."

Since the only novelty in Shimadzu's claims is the production of lead sub-oxide it is necessary for him in order to establish a prima facie case to show that defendant is making lead sub-oxide. Since the above quotation is an admission that there is no novelty in the steps of the process or the details of the apparatus disclosed and claimed by Shimadzu, there is no basis for giving him access to defendant's plant in order to obtain information in regard to these features.

In regard to the product, Shimadzu in the interference case successfully contended that plaintiff's product was not, and is not, lead sub-oxide and that defendant cannot make lead sub-oxide in his apparatus. This statement is supported by the following quotations from briefs for Shimadzu in the interference case.

In the brief for Shimadzu before the United States Court of Customs and Patent Appeals, page 16, the following statement is made:

"The color of suboxide of lead mixed with a small proportion of lead powder, as shown by Shimadzu's samples, is black. The color of Hall's powder as set forth in his application for patent, 'olive gray,' would as accurately as any other words describe the color of a mixture of litharge and pure lead powder."

Near the bottom of page 26 of the same brief the following statement appears:

"Mr. Hall and all his witnesses repeatedly admitted that his product shows olive gray in color as specified in his specification."

In the brief for Shimadzu before the Board of Appeals in the interference case on page 67, paragraph 5, the following statement is made:

> "5. That even if it be assumed that the apparatus of Hall's application could produce lead suboxide in appreciable amounts, *and it cannot*, there is no disclosure in Hall's testimony as to what form of apparatus or what process he finally considered was a satisfactory reduction to practice prior to the filing of the Hall application."

Shimadzu's testimony was corroborated and was accepted by the Court of Customs and Patent Appeals instead of Hall's testimony.

On this testimony for Shimadzu the Court found that Hall never disclosed suboxide of lead and, therefore, could not claim a powder in which it predominated. Therefore, the Court held that Shimadzu, who did disclose suboxide of lead, was the first inventor of it and entitled to patent claims for it.

The Court also found, top of page 226, second column, 59 Fed. (2nd) that Shimadzu was limited to July 14, 1923, for both conception and reduction to practice of the lead suboxide invention.

As pointed out in Defendant's Answer to the Motion for Inspection, page 5, Par. a, Hall was given the early part of 1921 as the date of the invention described and claimed in his application and which the Court held did not involve suboxide of lead. The Hall application referred to is now patent 1,888,823, under and in accordance with which the Defendant is operating.

Since the early part of 1921, Hall's date of invention, is more than two years prior to July 14, 1923, Shimadzu's date of invention, it appears that if Hall's process, product and apparatus infringe Shimadzu's patent they must also anticipate Shimadzu's patent

and thus negative any idea of prima facie proof of infringement such as is necessary to support a motion for inspection. In fact, these dates raise a presumption of no infringement. Plaintiff is between the horns of this dilemma as was stated at the oral argument of this case.

To extricate itself from this position Plaintiff in its Supplemental Brief, pages 3 and 12, refers to the following statement in Shimadzu's patent 1,584,150:

> "This application is a continuation in part of application No. 431,473, filed Dec. 17, 1920."

Patent 1,584,150 is the suboxide patent and it was involved in the Shimadzu-Hall interference where the same contention was unsuccessfully made because the Court of Customs and Patent Appeals notwithstanding that statement in the patent gave Shimadzu July 14, 1923, as the date of his invention.

THE APPLICATION FOR PATENT 1,584,150 IS NOT A CONTINUATION OF APPLICATION 431,473 IN RESPECT TO LEAD SUBOXIDE.

It is obvious that the application for patent No. 1,584,150, filed July 14, 1923, could be a continuation of the earlier application No. 431,473, filed Dec. 17, 1920, only to the extent that the earlier application contained the same subject matter or part of the same subject matter as the later application. We file herewith a certified copy of application 431,473. From that copy it appears that the application 431,473, as filed in 1920, said nothing about rubbing together lumps of lead in a tumbling mill and producing lead powders, as stated at the bottom of page 2, and the top of page 3, of Plaintiff's Supplemental Memorandum on Motion for Inspection, or about a mill nor about pro-

ducing lead suboxide other than to state: "It is also necessary that fresh lead powder is employed, as suboxidized lead is less active than pure lead." On July 18, 1922, an amendment was presented and in it reference was made to a mill but not to lead suboxide. The Patent Office held that this amendment covered new matter and refused to enter it and held that the disclosure was insufficient. Another amendment was presented May 2, 1924, and in reply on May 20, 1924, the Patent Office repeated its objection and the application became forfeited and dead.

At no time was there in application 431,473, any description of a mixture of suboxide of lead and metallic lead, or of any method of making the same.

At the oral argument of this case, as reported stenographically, and on page 73, Mr. Newton, of counsel for Plaintiff, stated: "that there was as good a disclosure in the Shimadzu case of 1920, as there was in the Hall case." The 1920 case of Shimadzu is application Ser. No. 431,473, and the Court of Customs and Patent Appeals held that in Hall's case there was no disclosure of the suboxide powder. From Mr. Newton's statement it follows that in Shimadzu's 1920 case there was no disclosure of suboxide of lead; consequently it follows that the suboxide of lead invention of the patent in suit cannot be carried back to the date of the 1920 application.

MORGAN vs. DANIELS.

Plaintiff in its original Memorandum refers to Morgan vs. Daniels, 153 U. S. 121. The head note in that case is as follows:

> "When a question between contending parties, as to priority of invention, is decided in the Patent Office, the decision then made must be accepted as controlling, upon that question of fact in any sub-

sequent suit between the same parties, unless the contrary is established by testimony which, in character and amount carries thorough conviction."

In the present case the parties are the same as the parties to the litigation in the Patent Office, and on the question of priority of invention the Patent Office decided that as to the lead suboxide invention Shimadzu was first and entitled to a patent, and that as to Hall, Hall's powder was ahead of Shimadzu, or otherwise stated, the Patent Office decided that Shimadzu had a right to a patent for the lead suboxide proposition, and that Hall had a right to a patent for his process, product and machine. Applying the doctrine of Morgan vs. Daniels it seems that the Patent Office decision must be accepted as controlling. If the Patent Office decision means anything it means that Hall was first in point of time and that Hall was not entitled to make claims for Shimadzu's lead suboxide proposition because Hall never disclosed it at any time. Another way to put it is to say that the Patent Office decided that each of the parties was entitled to a patent for his invention and that Hall made his invention first. The application of Morgan vs. Daniels seems to negative the proposition that Hall and the Defendant are infringing Plaintiff's Shimadzu Patent.

In addition to the above it appears from Paragraph 3 of Defendant's Answer to the Motion for Inspection that Defendant has been using and or making the same product which it is now making, beginning in 1908.

QUESTION OF INSPECTION.

In considering the question of inspection, the equities may well be balanced. On Defendant's side

is the result of twenty-six years of experience concerning the exact temperatures employed and the details of operation, mechanical arrangement and the like. On Plaintiff's side is the comparatively newcomer of only ten years' standing, with a lead suboxide proposition which the Court of Customs and Patent Appeals has said was never disclosed by Hall and which the Patent Office said was later even than Hall.

—ooo—

Plaintiff rejects or at any rate does not ask for a sample of Defendant's product, and at page 14 of its Supplemental Memorandum gives the following ground for its action. Contrary to its testimony in the interference, and to the decision in the interference proceedings and contrary to the decision of the Court of Customs and Patent Appeals to the effect that lead suboxide cannot be made in a Hardinge mill by Hall's process, Plaintiff now wants this Court to assume that Defendant is making a lead suboxide powder in a Hardinge mill and upon that assumption asks this Court to order an inspection and disclosure extending way beyond the claims of the lead suboxide patent in suit.

Of the six patents in suit, the pivotal patent is 1,584,150. In this patent claims 1 to 13, inclusive, are process claims, while claims 14 to 17 are product claims. To determine infringement of the product claims, inspection of Defendant's plant is not essential.

The process set forth in the claims of this patent includes the following steps, viz.:

(a) Putting pieces of metallic lead into a rotatable vessel in a dry state,

(b) Introducing a current of air or other oxidizing gas into the vessel.

(c) Rotating the vessel, thereby abrading off the oxide formed on the surface of the lead.

(d) Maintaining the temperature of the material between 60° C. and 200° C.

Defendant admits that it is employing these steps in its process, as disclosed in the Hall patent 1,888,823, and has been using them since 1916.

Claim 2 calls for blowing the powder out of the mill.

Defendant admits that a small portion of his product is carried out of the mill in the dust laden air, as disclosed in the Hall patent but the greater proportion is discharged in accordance with the well-known principle of the Hardinge mill without depending upon the air blast.

Claim 5 calls for a heat insulating means.

Defendant uses no heat insulating means, but on the contrary employs cooling means, as disclosed in the Hall patent.

Claim 7 includes steel balls with the pieces of lead.

Defendant does not use steel balls.

The facts in respect to those elements in plaintiff's process claims which defendant denies using may all be determined by interrogatories, without inspection of the plant.

Plaintiff has no right to gain by inspection of defendant's plant, knowledge of those features of Defendant's process or those details of Defendant's apparatus which are outside of the scope of the claims of the patents in suit. For example, he has no right to know the size or shape of the pieces of lead fed into

Defendant's mill, nor the rate of such feed, nor the device or devices by which such feed is effected. Knowledge as to whether Defendant does or does not put pieces of lead into a rotating vessel is all that he is entitled to, and such knowledge is available without inspection. Plaintiff is not entitled to know the exact temperature maintained in Defendant's mill nor the means by which the temperature is controlled. Knowledge as to whether or not such temperature is held within the limits of 60° C. to 200° C. is all that Plaintiff is entitled to, and it has been admitted and is now admitted that it uses a temperature within those limits.

Plaintiff is not entitled to know the quantity of air supplied to Defendant's mill, nor the means for controlling it. Knowledge that air is supplied to the mill is all that Plaintiff is entitled to, and it has been admitted and is now admitted that air is supplied to the mill.

The process of the two claims of Shimadzu's patent 1,584,149, includes no other steps than those already referred to and does not therefore entitle Plaintiff to inspection of Defendant's plant.

The claims of Shimadzu's patent 1,584,151, cover a process for further oxidation of the product covered by patent 1,584,150. Defendant has submitted affidavits absolutely denying the use of any such process. No inspection is required in respect to these claims.

The claims of Shimadzu's patent No. 1,584,152, cover the use of lead oxide powder resulting from the process of patent No. 1,584,150, in the manufacture of paint. Defendant has submitted an affidavit denying the use of his lead oxide powder in the manufacture of paint. No inspection of Defendant's plant is required in respect to these claims.

The claims of Shimadzu's patent No. 1,584,479

cover the use of a lead suboxide powder in the manufacture of storage battery plates. Defendant admits that it uses its lead oxide powder in the manufacture of storage battery plates. No inspection of Defendant's plant is necessary.

Shimadzu's patent No. 1,896,020, was issued on an application filed April 27, 1926. It discloses his apparatus for the manufacture of lead oxides, and its claims are directed to specific features of such apparatus not used by Defendant. Defendant has filed affidavits stating that the apparatus it uses is the same as it used more than two years before the filing date of Shimadzu's patent. If further information is required in regard to Defendant's use of specific features covered by the claims of the Shimadzu patent No. 1,896,020, such as the use of a screw conveyor for feeding the pieces of lead into the drum, or the use of jets for delivering compressed air into the interior of the drum, or the use of an injector in the outlet of the drum, or the supplemental means for the further oxidation of the powder into litharge, none of which features is employed by the Defendant, such information can be obtained by interrogatories, without inspection of Defendant's plant.

Résumé.

Perhaps in repetition of what has been stated in Defendant's Answer to the Motion we may add the following résumé.

An order of inspection is not to be granted as of course, and protection will be given against impertinent intrusion; suspicion of infringement is not enough to justify an inspection, and a prima facie case or showing must be made. In the present case Plaintiff has failed to make a prima facie case or showing of infringement but, on the contrary, has made a prima fa-

cie case or showing of either non-infringement or of invalidity by anticipation.

In the Patent Office proceedings Hall, in whose shoes Defendant stands, introduced testimony (set out in Plaintiff's Supplemental Memorandum to the effect that Hall made lead suboxide powder in a Hardinge mill by his process, and Plaintiff introduced testimony (set out in this Memorandum) to the effect that lead suboxide could not be made in a Hardinge mill by Hall's process. The Plaintiff prevailed and has a patent for lead suboxide, and Hall has a patent for his process, product and machine, which was given the date of the early part of 1921, whereas Shimadzu was given the date of July 1923; and it has been shown that the application No. 431,473, of 1920, totally lacks any disclosure upon which the date of Shimadzu's suboxide invention can be carried back. Defendant swears that it is using, and always has used, the Hall process in a Hardinge mill, and Plaintiff gives no evidence of any change in the process but merely suspects infringement which is not enough to warrant inspection. At the oral argument Mr. Whitcomb, page 64, in answer to a question by the Court, stated that Plaintiff's case depends entirely on Hall's testimony. At page 64, the Court stated Defendant's contention, saying in substance, if Hall is wrong then there is not even a prima facie case of infringement, because Plaintiff was not doing anything that infringed the patent. If Hall is right his own testimony shows that he did what Defendant is now doing at a date early enough to anticipate the patent. Therefore, Plaintiff's patents cannot be upheld. In reply, page 65, Mr. Whitcomb stated that Shimadzu was entitled by reason of his 1920 application 431,473, to a date sufficiently early to avoid anticipation of the patent in suit. The Court then remarked that if Shimadzu was entitled to that

early date Defendant's argument was destroyed. The slightest glance at the certified copy of that application shows that Mr. Whitcomb's contention is without foundation. Hall's testimony is competent to show admissions made by him in another suit but it certainly is not conclusive against him or the Defendant and does not constitute an estoppel. It is inconceivable that Hall's testimony can be viewed as establishing even a prima facie case of infringement, in favor of Shimadzu, who was a party to the Patent Office proceedings, and who established by testimony not only that Hall was wrong, but also the impossibility of making suboxide of lead and thereby infringing Plaintiff's patent by Hall's process in a Hardinge mill; and in the Patent Office proceedings it was established that Hall operated with a Hardinge mill. Shimadzu having defeated the right to patent the suboxide matter of Shimadzu's patent 1,584,150, which Hall was asserting in the Patent Office, by successfully contradicting Hall's testimony and affirmatively showing that Hall was mistaken or wrong and that Hall never had and could not have lead suboxide, cannot now say that Hall's same testimony is proof of infringement of that lead suboxide patent. Hall's testimony was either right or wrong, and not both, and Shimadzu having by testimony in the Patent Office established that Hall's testimony was wrong, cannot in this Court say that Hall's same testimony is right.

In these circumstances, and in its efforts to make a prima facie case or showing of infringement, Plaintiff asks this Court to overrule the Supreme Court of the United States in Morgan vs. Daniels, 153 U. S. 121, and to reverse the decision made in the Patent Office and affirmed by the Court of Customs and Patent Appeals between the same parties, and further Plaintiff asks this Court to accept Hall's discredited testimony as establishing a prima facie case of infringement of

Plaintiff's suboxide patent, and Plaintiff further asks this Court to read into the 1920 application, Ser. No. 431,473, the lead suboxide invention which is obviously absent from it.

We confidently submit that this Court in the exercise of its discretion should decline to comply with Plaintiff's request, especially in view of the fact that Plaintiff is a competitor newly arrived in the field long occupied by Defendant, and of the further fact that Plaintiff is now posing as a suitor.

Respectfully submitted,

HUGH M. MORRIS,
AUGUSTUS B. STOUGHTON,
A. F. KWIS,
E. S. W. FARNUM, JR.

NOTICE OF DEFENDANT'S MOTION FOR BILL OF PARTICULARS.

(Filed June 8, 1935.)

Please take notice that on the 12th day of June, 1935, at ten o'clock in the forenoon, or as soon thereafter as counsel can be heard, at the United States District Court for the Eastern District of Pennsylvania, at the Post Office Building, 9th & Chestnut Streets, City of Philadelphia, State of Pennsylvania, the attached Motion will be presented.

AUGUSTUS B. STOUGHTON,
E. S. W. FARNUM, JR.,
HUGH M. MORRIS,
Solicitors and of Counsel for Defendant.

To:

Joseph Henderson, Esq.,
Rawle & Henderson,
Packard Building,
Phila., Pa.,
Solicitors and of Counsel
for Plaintiffs.

DEFENDANT'S MOTION FOR BILL OF PARTICULARS.

(Filed June 8, 1935.)

And now comes the defendant, The Electric Storage Battery Company, and moves, pursuant to Equity Rule 20, and pursuant to a stipulation of counsel extending the time of either party to take depositions or testimony or to move for further and better statement of the nature of the claim or defense or of any matter stated in any pleading under Rule 20, or to file interrogatories under Rule 58, to and including June 30, 1935, that the plaintiffs be ordered to furnish a further and better statement of the nature of their claim as set forth in their Bill of Complaint in the following respects:—

1. By setting forth or specifying the claim or claims of each of plaintiffs' patents relied upon as having been infringed by the defendant.

2. By setting forth more definitely and furnishing particulars describing the steps in the process of defendant on which the plaintiffs will rely at the trial to establish infringement.

3. By setting forth definitely or describing the

parts or elements of defendant's apparatus that the plaintiffs will rely upon at the trial to establish infringement of the apparatus claimed:

All for the reason that the statements in the Bill of Complaint are so vague and indefinite that the defendant cannot intelligently prepare its defense thereto. And defendant moves that such order as to costs may be made herein as may be just.

Bill of Particulars to be filed on or before June 24, 1935.

E. S. W. Farnum, Jr.,
Augustus B. Stoughton,
Hugh M. Morris,
Solicitors and of Counsel for Defendant.

NOTICE OF MOTION FOR LEAVE TO FILE INTERROGATORIES.

(Filed June 8, 1935.)

Please take notice that on the 12th day of June, 1935, at ten o'clock in the forenoon, or as soon thereafter as counsel can be heard, at the United States District Court for the Eastern District of Pennsylvania, at the Post Office Building, 9th & Chestnut Streets, City of Philadelphia, State of Pennsylvania, the attached Motion will be presented.

E. S. W. Farnum, Jr.,
Augustus B. Stoughton,
Hugh M. Morris.

To:

Joseph Henderson, Esq.,
Rawle & Henderson,
Packard Building,
15th & Chestnut Sts.,
Phila., Pa.,
Solicitors and of Counsel
for Plaintiffs.

DEFENDANT'S MOTION FOR LEAVE TO FILE INTERROGATORIES AFTER EXPIRATION OF TWENTY-ONE DAYS.

(Filed June 8, 1935.)

Now comes the defendant in the above entitled cause and asks leave of court to file interrogatories in writing hereto annexed to be answered by the plaintiff, an officer of the Northeastern Engineering Corporation, and if Genzo Shimadzu is out of this country, by his attorney in fact or authorized representative, if any, in this country under oath.

The reason why said interrogatories were not filed before is that by stipulation of solicitors and counsel the time to file interrogatories under Rule 58 was extended to and including June 30, 1935.

AUGUSTUS B. STOUGHTON,
E. S. W. FARNUM, JR.,
HUGH M. MORRIS,
Solicitors and of Counsel for Defendant.

Dated:
June 6, 1935.

INTERROGATORIES PROPOUNDED BY DEFENDANT.

(Filed June 8, 1935.)

Interrogatories propounded by the defendant pursuant to Equity Rule 58 and to be answered by an officer of the Northeastern Engineering Corporation, and if Genzo Shimadzu is out of this country, by his attorney in fact, or authorized representatives, if any, in this country, under oath.

Interrogatory No. 1. State whether or not Genzo Shimadzu, the plaintiff above named, and the patentee of the United States patents in suit, is the same individual to whom issued the Japanese and British patents referred to and set forth on pages 10, 11 and the top of page 12 of defendant's printed answer.

Interrogatory No. 2. State whether or not the translations of said Japanese patents heretofore submitted to counsel for plaintiff by counsel for defendant are substantially correct.

Interrogatory No. 3. If the answer to Interrogatory No. 2 is in the negative state wherein said translations are not substantially correct in plaintiffs' opinion.

Interrogatory No. 4. State whether the conceptions of the inventions of the respective patents in suit occurred in a country foreign to the United States.

Interrogatory No. 5. If the answer to Interrogatory No. 3 is in the affirmative, state the dates when the inventions of the respective patents in suit were first communicated to someone in the United States.

Interrogatory No. 6. State the dates of the inventions of the several patents in suit.

The plaintiffs are required to answer these interrogatories on or before June 24, 1935.

E. S. W. Farnum, Jr.,
Augustus B. Stoughton,
Hugh M. Morris,
Solicitor and of Counsel for Defendant.

Dated:

June 7, 1935.

INTERROGATORIES PROPOUNDED BY PLAINTIFFS, PURSUANT TO EQUITY RULE 58, TO BE ANSWERED BY THE OFFICER OF THE DEFENDANT, ELECTRIC STORAGE BATTERY COMPANY MOST FAMILIAR WITH THE FACTS, UNDER OATH.

(Filed June 22, 1935.)

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1. State whether or not at the bottom of the bag collector where the material is transferred to the screw conveyor, there is a rotary gate valve at Point A marked on the accompanying drawing S. B. 26478-1.

2. Please state the same thing with respect to Point B and B′ at the bottom of the cyclone separator.

3. With respect to the bucket conveyor connection to the entrance end of the Hardinge Mill, please state whether or not there are any gates at the zone "C" to prevent air coming in the inlet pipe containing the Pitot tube and passing down the chute containing the bucket conveyor.

4. Please state whether or not the feed valve has

been used continuously for six years prior to the filing of the bill of complaint herein, when the automatic feeding devices were used, or when fed by hand.

5. How long has defendant used the Pitot tube in the inlet pipe, or any other means for measuring the volume of air entering the mill, as shown on the drawing SB 26478-1. Particularize with respect to such uses and types, if any other type than the Pitot tube has been used.

6. In connection with Patent No. 1584479 please state whether or not defendant has within six years prior to the filing of the bill of complaint herein, mixed or kneaded powder formed from the metallic lead by the process employed by defendant, using the apparatus illustrated in the drawing attached to or described in the report of Dr. Wilson, with a liquid to form a paste for storage battery places. If so give the proportions of all materials used to form the paste.

7. If your answer to the foregoing interrogatory is "yea", please state whether defendant within six years prior to the filing of the bill of complaint herein, applied the paste thus formed to the grids for storage batteries.

8. In connection with Patent 1584152, please state whether or not defendant for six years prior to the filing of the bill of complaint herein has used and or sold any products manufactured by the apparatus shown in the drawing attached to Dr. Wilson's report or described by Dr. Wilson in his report, for paints or paint pigaments.

RAWLE & HENDERSON,
HUNT, HILL & BETTS,
EDMUND B. WHITCOMB,
Solicitors for Plaintiffs.

Dated, June, 1935.

MOTION FOR FURTHER AND BETTER PARTICULARS OF DEFENSES.

(Filed July 9, 1935.)

And now comes plaintiffs by their counsel and move for an order requiring the defendant, on or before the day of July, 1935, to file further and better particulars of the defenses in the answer herein, as follows:

1. What United States and/or foreign patents and what United States and/or foreign publications will be offered in evidence at the trial of this cause:

(a) to illustrate the prior state of the art;

(b) for the purpose of anticipation of any claim of any of the patents in suit;

(c) for any other purpose.

(d) Point out as to each of the items (a), (b) and (c) with respect to each claim of the several patents in suit as specified by plaintiffs as the claims upon which plaintiffs will rely.

2. State each instance upon which defendant will attempt to prove on the trial of this cause:

(a) As to any alleged prior knowledge or use as alleged in ¶ 23 and 260y the answer and point out the same as against each claim in suit of each patent in suit.

(b) As to any alleged independent invention or inventions as alleged in the last four lines of paragraph 23 of the answer or otherwise, and particularize with respect to each claim in suit of each patent in suit.

(c) As to any alleged prior use in the United States for more than two years prior to the application date of any and/or all of the patents in suit and particularize with respect to each claim in suit of each patent in suit.

In connection with the foregoing sub-divisions (a), (b) and (c) furnish plaintiffs with:

(1) All blue prints to scale of each such installation upon which defendant will rely at the trial of this cause, particularly including the alleged 1916, 1918 and 1920-21 instances referred to in the various affidavits heretofore filed in this cause.

(2) All descriptive matter in detail as to the construction of each feature of, and all operating data and each process step relating to the operation of each alleged prior use upon which defendant will rely at the trial of this cause in support of any defense of prior knowledge and/or use.

(3) Information stating within whose knowledge said alleged prior use for more than two years prior to the applications for the patents in suit occurred, stating specifically where (street address, town and state) and day when such alleged prior knowledge and/or use occurred, particularizing with respect to each and every instance upon which defendant will rely on the trial of this cause.

3. As to paragraph 23 of the answer, particularize in detail upon what facts, etc., defendant will rely at the trial to show that it "required no invention" to produce the improvements, being specific as to each

patent in suit relied upon by plaintiffs, and likewise as to defendant's proofs that the same "were not patentable invention or improvement within the meaning of the law".

4. As to paragraph 25 of the answer, particularize specifically as to each claim in suit of each patent in suit, stating which foreign patent or patents giving country, number of such foreign patent or patents, date of issuance and date of filing, "by said Shimadzu" upon which defendant will rely at the trial, and which it claims render each patent "null, void and invalid" as alleged.

5. (a) Specify in detail upon what different patents, United States and foreign, and/or publications, defendant will rely at the trial as against each claim in suit of each patent in suit.

(b) If more than one prior art item will be urged against any one claim, state in particular whether defendant intends to use the same separately or combined, and if combined specify how defendant proposes to combine the same as against each such claim.

Bill of Particulars to be filed on or before July 1935.

RAWLE & HENDERSON,
HUNT, HILL & BETTS,
Solicitors for Plaintiffs.

E. B. WHITCOMB,
Of counsel.

DEFENDANT'S BILL OF PARTICULARS.
(Filed Aug. 29, 1935.)

Defendant herein, by its attorneys—Hugh M. Morris, Edward S. W. Farnum, Jr. and Augustus B. Stoughton, for further and better particulars, says:

1. As at present advised, see printed answer Section S 25 and 26 and Schedule A, also the patents mentioned in (a) below.

(a) Starting with Hyde on page 12 of the printed answer through page 15 thereof and Section 26 of the answer and in addition

British patent #4809 of 1882 to Tathani et al for improvements in secondary batteries.
U. S. patent #266,762 of October 31, 1882 to C. F. Brush.
U. S. patent #849,555 of April 9, 1907 to Montgomery.

(b) See answer to (1)

(c) All of the foreign patents to Shimadzu set up in the answer, plus Canadian patent 243,794 of October 21, 1924, filed February 19, 1923.

(d) See answer (a) as to each of the claims in suit. As to (b) under (d) the Hyde British patent #19981 as to patent 1,584,149, claims 1 and 2, U. S. patent 1,584,150, claims 1, 2, 3, 4 and 11, U. S. patent 1,584,151, all claims.

British patent 14,794 to Coleman, claims 14, 15, 16 and 17 of 1,584,150.
Bischof British patents 13,202 of 1898 and 11,602 of 1890, U. S. patent 1,584,150, claims 15, 16 and 17.

U. S. patent 846,384, 1907, to Bailey. Claims 1 and 2 of 1,584,149. All claims in suit of #1,584,150 and in connection with patent 846,444 referred to therein, claim 1 of 1,584,151 and claims 1 and 2 of 1,584,152.

Thibault U. S. patent #1,482,327, 1924, and French patent 494,270 of 1919, claims 9, 10, 11, 12 and 13 of patent 1,584,150.

Belgian patent 284,885 and publication thereof in 1920, claim 1 of 1,584,149, claims 1, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16 and 17 of 1,584,150. All claims in suit except 5, that is claims 1 to 4 of 1,158,151.

U. S. patent 645,978 to Silvey against all the claims of 1,584,479.

U. S. patent 723,327 to Sperry, claims 1, 2, 3, 4, of 1,584,479

Akkumulatoren Und Galvanischen Elemente by Dr. L. Lucas as to all claims 1,584,479.

Answering (c) under (d), 1,584,149 is invalid under Section 4886, R. S. on Japanese patents 41,728 and 42,563 as to both claims.

U. S. patent 1,584,150, all claims in suit invalid on Japanese patents 41,728, 42,562 and 42,563.

U. S. patent 1,584,151, all claims in suit invalid on Japanese patent 41,953 and on Canadian patent 243,794.

U. S. patent 1,584,152, all claims invalid on Japanese patent 40,704.

U. S. patent 1,584,479, all claims in suit invalid on Japanese patents 42,861 and 42,862.

U. S. patent 1,584,151, all claims in suit invalid on British patent 176,924.

U. S. patent 1,584,150, all claims invalid on British patent 197,031.

NOTE. The above answers are made in the light of the translations of the Japanese patents now in possession of defendant and which were submitted sometime ago to plaintiff for an expression of views which however at the date hereof has not been forthcoming.

(2) Answering (a) and (b), all patents and public uses set up in the answer except the Shimadzu patent.

Answering (c) as to prior use applied to each claim of each patent in suit, see answer to interrogatory #1.

Answering Section 1 under interrogatory 2, blueprints identified as follows are submitted herewith:

AFA 14-311, 6-11-12
A-328 July 24, '16
SB-288-2 September 25, 1915
SB-286-2 March 23, 1916
SB-201 March 11, 1915
SF-2427-1 November 14, 1920

Answering paragraph 2 under interrogatory 1 and as at present advised, there is submitted herewith copies of typical records dated August 3, 1916, also August 4, 1916 and August 7, 1916, also lead dust manufacture Kershaw to Willard Company dated July 24, 1917, also Smith to Norberg dated October 3, 1919, also all records prior to July 14, 1921, log sheets beginning February 11, 1921, for every day the mill was run, of which 1 typical sheet dated April 13, 1921 is produced.

NOTE: Defendant's process is not a step process. It is a continuous unitary process.

Answering interrogatory 3, among others Edward Wanton Smith, 535 Church Lane, Philadelphia, William Ernest Kershaw, Gwynedd Valley, Montgomery County, Clarence A. Hall, 7951 Winston Road, Chestnut Hill, Philadelphia, Benjamin Shablin, 3858 Penns Grove Street, Philadelphia, John D. Kohl, 54 West Johnson Street, Philadelphia, Pennsylvania, W. L. Reinhardt, 246 East 131 Street, Cleveland, Ohio. The uses occurred at 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania, and at 246 East 131st Street, Cleveland, Ohio on days too numerous to mention from 1907 in one case and from 1920 in the other case.

Answering interrogatory 3, the whole prior art set up in this case as to each claim in suit of each patent in suit.

Answering interrogatory 4 and as at present advised 1,584,149 both claims on Japanese patent applied for November 21, 1920, issued February 13, 1922, #41728 and 42563 applied for November 27, 1920, issued May 10, 1922.

1,584,150, all claims in suit, Japanese patents 41,728 filed November 21, 1920, issued February 13, 1922, 42,562 filed November 27, 1920, issued May 10, 1922, 42,563 applied for November 27, 1920, issued May 10, 1922. British patent 197,031 filed February 7. 1922, issued May 7, 1923.

1,584,151, Canadian patent filed February 19, 1923, issued October 21, 1924 #243,794, Japanese patent 41,953 August 29, 1920, issued March 10, 1922.

1,584,479, Japanese 42861-2 patent filed August 3, 1921, issued June 17, 1922, Japanese patent 41,728 filed November 21, 1920, issued February 13, 1922 and Japanese patent 42,563 filed November 27, 1920, issued May 10, 1922.

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Answering interrogatory 5, (a) and (b), see answers to interrogatory #1.

AUGUSTUS B. STOUGHTON,
HUGH M. MORRIS,
E. S. W. FARNUM, JR.,
Attorneys for Defendant.

ABS:C
8-20-35

ANSWERS TO INTERROGATORIES.

(Filed Aug. 29, 1935.)

EASTERN DISTRICT OF PENNSYLVANIA, }
CITY AND COUNTY OF PHILADELPHIA. } *ss.*

R. C. NORBERG, having been duly sworn, says that he is Vice-President of the Defendant and that he makes the following answers to interrogatories propounded to the defendant in the above entitled case, to be answered by the officer of the defendant most familiar with the facts:

1. The answer to interrogatory 1 is "yes".

2. Answering interrogatory 2, the answer is "yes".

3. Answering interrogatory 3, the answer is "there is no valve and there is no appreciable flow of air in the chute containing the bucket conveyor".

4. Answering interrogatory 4, the answer is "a feed valve has been continuously used for 6 years prior to the filing of the bill of complaint herein".

5. Answering interrogatory 5, the answer is "a

pitot tube in the inlet pipe has been exclusively used since about March, 1921, in measuring the volume of air entering the mill".

6. Answering interrogatory 6, the answer is "yes". The proportions are 300 grams of powder and from 34 to 40 c. c. of water".

7. Answering interrogatory 7, the answer is "yes".

8. Answering interrogatory 8, the answer is "no".

R. C. NORBERG.

Sworn to and subscribed before me
this 29th day of August, 1935.

MURIELL T. CRANMER,
(SEAL) *Notary Public.*
My Commission Expires March 5, 1937.

AUGUSTUS B. STOUGHTON,
HUGH M. MORRIS,
E. S. W. FARNUM, JR.

ANSWERS OF NORTHEASTERN ENGINEERING CORPORATION and GENZO SHIMADZU, TO THE INTERROGATORIES ADDRESSED TO THE PLAINTIFFS BY DEFENDANT.

(Filed Sept. 13, 1935.)

ANSWER TO INTERROGATORY No. 1:

Genzo Shimadzu, one of the plaintiffs herein and patentee of the United States patents in suit, is the

same individual to whom were issued the Japanese and British patents referred to and set forth on pages 10, 11 and to of page 12 of defendant's printed answer.

ANSWER TO INTERROGATORIES Nos. 2 and 3:

The translations of the Japanese patents submitted to counsel for plaintiffs by counsel for defendants are substantially correct, subject to the following corrections:

Japanese Patent No. 42563:

(a) Page 2, line 6:

The words "tubes" and "them" should read: "pipe" (singular) and "it".

(b) Page 2, lines 11 and 18:

The words "(approximately 22 pounds)" should be stricken out.

(c) Page 2, lines 16 and 17:

The words "by the circulating air" should be stricken out.

(d) Page 3, line 11:

The words "(of the air)" should be stricken out.

Japanese Patent No. 60825:

(a) Page 2, last four lines:

The words following the semi-colon, reading: "and when it is supplied to the paste material for electrodes of storage batteries in the state of lead peroxide or litharge made by oxidizing it in this way, the results are very good."

should read:

"when the material is further oxidized in this way forming lead peroxide or litharge and it is supplied as the paste material for electrodes of storage batteries, the results are very good."

(b) Page 3, line 7:

Correct the spelling of "kwans".

(c) Page 3, line 8:

The words "(about 207 pounds)" should be stricken out.

(d) Page 3, line 12:

After the word "degrees" the word "centigrade" should be inserted.

(e) Page 3, line 21:

The word "or" should be changed to "and".

(f) Page 3, line 21:

After the word "oxidizing" the word "gas" should be inserted.

(g) Page 3, lines 30 to 34 inclusive:

The sentence beginning with the word "Presumably" and ending with the word "suboxide" should be stricken out and the following substituted therefor:

"Presumably as compared with these patented inventions the present invention accelerates the grinding action and very greatly increases the manufacturing efficiency of the product by especially maintaining the metallic lead material at the proper temperature during the formation of lead suboxide

Japanese Patent No. 41728:

(a) Page 2, line 14:

The words "33 ounce (250 monme)" should be stricken out and the words "250 kwans of" substituted therefor.

(b) Page 2, line 19:

Correct the spelling of "kwāns".

(c) Page 2, line 19:

The words "(12 pounds)" should be stricken out.

(d) Page 2, line 27:

The word "tube" should read "vessel".

(e) Page 3, line 10:

The words "in lead oxide" should be stricken out.

(f) Page 3, line 11:

The words "such as" should be inserted before the word "litharge" at the beginning of the line.

(g) Page 3, line 11:

The words "and paint material" should be inserted after the word "batteries".

(h) Page 3, line 13:

The word "contact" should read "catalytic".

Japanese Patent No. 41953:

(a) Page 1, line 13:

The word "having" should read "has".

(b) Page 1, line 14:

The words "is very rough because of such" should read "and has".

(c) Page 2, last line:

The words "bake or heat" should read "melt or roast".

(d) Page 3, lines 12 and 17:

The word "baking" should read "roasting".

Japanese Patent No. 42562:

(a) Page 1, 1st paragraph, line 6:

The word "forcing" should read "freely discharging".

(b) Page 2, line 3:

The word "forced" should read discharged".

(c) Page 2, line 9:

Correct the spelling of the word "kwans".

(d) Page 2, lines 9 and 10:

The words "(206-2/3 pounds)" should be stricken out.

(e) Page 2, line 16:

Correct the spelling of the word "kwans".

(f) Page 2, lines 16 and 17.

The words "(approximately 16.5 pounds)" should be stricken out.

(g) Page 2, next to last line:

The word "expulsion" should read "discharge".

(h) Page 3, last line:

The word "expelled" should read "discharged".

Japanese Patent No. 42564:

(a) Page 2, lines 1 and 6:

The word "copper" should read "steel".

(b) Page 2, lines 2 and 9:

Correct the spelling of the word "kwans".

(c) Page 2, lines 2 and 3:

The words "(206-2/3 pounds approximately)" should be stricken out.

(d) Page 2, line 9:

The words "(24.8 pounds about)" should be stricken out.

Japanese Patent No. 42861:

(a) Page 1, line 4 from bottom:

The word "it" should be stricken out.

(b) Page 1, line 3 from bottom:

The word "through" should read "though".

(c) Page 1, line 3 from bottom:

The words "it were" should be inserted after the word "through" (though).

Japanese Patent No. 42862:

(a) Page 1, line 5 paragraph 1:

The letter "d" should be stricken out of the word "liked".

(b) Page 1, line 2, paragraph 2:

The word "kneating" should read "kneading".

(c) Page 1, line 3, last paragraph:

The word "grinded" should read "ground".

(d) Page 1, line 5, last paragraph:

The word "Kneat" should read "Knead".

(e) Page 2, paragraphs numbered "1.)" and "2.)" should be stricken out and the following substituted therefor:

"1. In order to accomplish the object above described, a process of manufacturing storage battery plates characterized by filling the grid plates with a paste prepared by using metallic lead powder of fine state, possessing a pyrophoric nature and an apparent specific gravity of below 3.0; which is produced by a mechanical abrasion instead of using ordinary oxide of lead and eliminating the necessary formation procedure.

2. In order to accomplish the object above described, storage battery plates as described in above paragraph characterized by effecting the formation procedure during the initial charging operation after drying of the plates filled with the paste prepared by kneading of fine metallic lead powder with a liquid which produces no injury to the storage battery, such as water or dilute sulphuric acid."

Japanese Patent No. 45093:

(a) Page 1, 1st paragraph, line 3:

The word "amorphous" should be inserted between the words "fine" and "powdered".

(b) Page 1, 1st paragraph, line 4:

The words "light in character and is" should be stricken out.

(c) Page 1, 1st paragraph, line 6:

The word "painting" should read "spreading".

(d) Page 1, 2nd paragraph, line 4:

The word "paint" should read "spread".

(e) Page 2, line 1:

The word "the" should read "an".

(f) Page 2, line 2:

The word "finely" should read "fine".

(g) Page 2, line 2:

The word "amorphous" should be inserted before the word "powder".

(h) Page 2, line 3:

The word "of" should be inserted at the beginning of the line.

(i) Page 2, line 3:

The words "light in character" should be stricken out.

(j) Page 2, 2nd paragraph:

The paragraph beginning with the words "The lead suboxide" and ending with the words "this invention" should be stricken out and the following substituted therefor:

> "The lead suboxide used in this invention is in a very fine amorphous state and is produced by mechanical abrasion. Its principal constituent is composed of lead suboxide but owing to the nature of manufacturing process, it may possibly contain 1 to 40% of metallic lead powder and it may also include forming lead oxides which in accordance with the nature of lead suboxide oxidizes into a monoxide during the manufacture or when left in the atmosphere, but the product can be used in this invention without difficulty. That is, the lead monoxide produced by the oxidation of lead suboxide under room temperature possesses the same state of apparent specific gravity as that of the original material, lead suboxide, but differs in characteristics from a lead monoxide produced by fusing of lead and hence it produces plates of great durability and rich activity since it readily solidifies due to the action with water. Therefore even if the original material, lead suboxide contains other oxidized substances produced by slow oxidation during the storing they do not interfere with the practice of the present invention."

(k) Page 3, lines 6 and 8:

The word "transformation" should read "formation".

(l) Page 3, line 12:

The word "light" should read "amorphous".

(m) Page 3, line 3 from bottom:

The word "painted" should read "spread".

(n) Page 4, line 3:

The word "painting" should read "spreading on".

(o) Page 4, line 5:

The words "light in character" should read "amorphous".

(p) Page 4, line 2 from bottom:

The figure "10" should read "1".

ANSWER TO INTERROGATORY NO. 4:

Yes, in Japan.

ANSWER TO INTERROGATORY NO. 5:

Unable to answer this interrogatory at this time for lack of knowledge or information sufficient to form a belief.

ANSWER TO INTERROGATORY NO. 6:

In connection with the patents in suit relied upon by plaintiffs, plaintiffs will rely on the dates of conception in the early part of 1918; upon drawings dated in September, 1918, showing the first stages of the development of the inventions; on drawings dated in December, 1918, showing the inventions, and on various drawings and sketches in the spring of 1919, and on other drawings at other dates therebetween and in the summer of 1919; for a reduction to practice the construction of machines in January, 1919, successful operation thereof in the spring of 1919 and further machines embodying the inventions constructed upon a commercial scale in the summer of 1919.

Interrogatories have been addressed to Mr. Shimadzu under letters rogatory, requesting testimony as to these facts.

RAWLE & HENDERSON,
Packard Building,
Philadelphia, Pennsylvania,

HUNT, HILL & BETTS,
120 Broadway,
New York City, New York,

EDMUND B. WHITCOMB,
Ohio Bank Building,
Toledo, Ohio,
Solicitors for Plaintiffs.

L. S. ISHIMURA.

SOUTHERN DISTRICT OF NEW YORK }
CITY COUNTY AND STATE OF NEW YORK } *ss:*

L. S. Ishimura, being duly sworn, deposes and says that he is the authorized representative of Genzo Shimadzu, one of the plaintiffs herein, in this country; that said Genzo Shimadzu is not within the United States; that he has read the foregoing answers to interrogatories and that the same are true to the best of his knowledge, information and belief.

L. S. ISHIMURA.

Sworn to before me this
18th day of Sept., 1935.

TERESA DABBOWSKI,
Queens County Clerk's No. 297.
Queens County Register's No. 155.
New York County Clerk's No. 42.
New York County Register No. 6-D-25.
Commission expires March 30, 1936.
(Seal)

PLAINTIFFS' BILL OF PARTICULARS.

(Filed September 19, 1935.)

The plaintiffs herein, by their attorneys, Rawle & Henderson, Hunt, Hill & Betts, and Edmund B. Whitcomb, for further and better particulars, say:

1. No. 1584149—both claims.
1584150—claims 1—4 each inclusive; 6; 8-17 each inclusive.
1584151—claims 1-5 each inclusive.
1584152—As at present advised we will not rely on any claim of this patent in view of defendant's answer to plaintiffs' interrogatory No. 8.
1584479—claims 1-4 each inclusive.
1896020—claims 10 and 11.

2. As at present advised, and without admitting the right of the defendant to ask for the further particulars contained in 2, and excepting to such demand, and reserving their exception and objection, plaintiffs state that the steps of the process of defendant on which plaintiffs will rely at the trial to establish infringement more particularly include steps of introducing raw lead into a revolving vessel and forming metallic lead powder, lead suboxide and litharge and/or a combination of any of them as a primary and/or secondary stage of the various processes and reactions taking place in defendant's apparatus, as illustrated in the drawing SB 26478-1 attached to Dr. Wilson's report made under order of Court herein and/or as described in the operation of said apparatus as contained in said report, subject to correction should error subsequently appear at the trial or other steps or processes, as may be shown to have been used by defend-

ant within the period of six years prior to the filing of the bill of complaint.

3. As at present advised, and without admitting the right of the defendant to ask for the further particulars contained in 3, and excepting to such demand, and reserving their exception and objection, plaintiffs state that they will rely at the trial to establish infringement of the apparatus claimed, upon the apparatus used by defendant as illustrated in the drawing SB 26478-1 attached to Dr. Wilson's report made under order of Court herein and or as described in the operation of said apparatus as contained in said report, subject to correction should error subsequently appear at the trial, or other apparatus as may be shown to have been used by the defendant within the period of six years prior to the filing of the bill of complaint.

Dated, September 18, 1935.

RAWLE & HENDERSON,
Packard Building,
Philadelphia, Pa.,

HUNT, HILL & BETTS,
120 Broadway,
New York City, N. Y.,

EDMUND B. WHITCOMB,
Ohio Bank Building,
Toledo, Ohio,
Solicitors for Plaintiffs.

ORDER FOR LETTERS ROGATORY.
(Filed July 9, 1935.)

On the motion of the solicitors for the plaintiffs and after hearing counsel for the respective parties, it is

Ordered, that letters rogatory issue out of and under the seal of this Court, directed to the appropriate judicial authority in Japan, requesting it to cause to be called and summoned before it, or before such official as it may appoint, Genzo Shimadzu, Suyeharu Uchiyama and Tominosuke Hichijo of Kyoto, Japan, witnesses on behalf of the plaintiffs, to give evidence in the above entitled cause in answer to the written interrogatories of the plaintiffs and the cross-interrogatories of the defendant, if any there be attached to said letters rogatory; and it is

Further Ordered, that a translation of this order, of the letters rogatory and of the interrogatories and cross-interrogatories into the Japanese language shall be attached to said letters rogatory; and it is

Further Ordered, that all objections, except as to the form of the questions, are reserved until the trial, and that Rawle & Henderson or Hunt, Hill & Betts, solicitors for the plaintiffs are authorized to withdraw the return to the letters rogatory from the files of the Court when the same may have been received from Japan, after having them photostated under directions of the Clerk for the purpose of making translations thereof, and shall thereupon serve copies thereof upon the solicitors for the defendants, and that the fees in connection with said letters rogatory and of the stenographer and interpreter, if any, be taxable as disbursements herein.

W. H. KIRKPATRICK,
U. S. D. J.

July 3, 1935.

ORDER OF AMENDMENT.
(Filed September 23, 1935.)

On consent of the parties hereto, it is

Ordered, that the third paragraph of the order of this court entered herein on July 3, 1935, providing for the issuance of letters rogatory in Japan to take the testimony of Genzo Shimadzu, Suyeharu Uchiyama and Tominosuke Hichijo of Kyoto, Japan, be modified and amended so as to read as follows:

> "Further Ordered that a translation of this order and of the letters rogatory into the Japanese language shall be attached to said letters rogatory, but that a translation of the interrogatories and cross-interrogatories need not be attached, and that the testimony of the witnesses may be taken through an interpreter, the questions being interpreted and addressed to the witnesses in Japanese and the answers received in Japanese, interpreted and taken down in English."

W. H. KIRKPATRICK,
U. S. D. J.

We hereby consent to the entry of the foregoing order.

RAWLE & HENDERSON,
HUNT, HILL & BETTS,
Solicitors for Plaintiffs.

E. S. W. FARNUM, JR.,
AUGUSTUS B. STOUGHTON,
HUGH MORRIS,
Solicitors for Defendant.

NARRATIVE STATEMENT OF EVIDENCE.

BE IT REMEMBERED that at the trial of the above-mentioned cause, before the Honorable William H. Kirkpatrick, District Judge for the Eastern District of Pennsylvania at Easton, Pennsylvania, begun September 25, 1935, the following proceedings were had and evidence introduced which is hereby reduced to narrative form pursuant to Equity Rule 75.

The plaintiffs appeared by Edmund B. Whitcomb, Esq., Joseph W. Henderson, Esq., George Whitefield Betts, Jr., Esq., George Yamaoka, George H. Souther and Carl F. Schaffer, as counsel.

Defendant appeared by Hugh M. Morris, Esq., A. B. Stoughton, Esq. (and E. S. W. Farnum, Jr., Esq.) and A. F. Kwis, Esq., as counsel.

PLAINTIFF'S EVIDENCE.

Counsel for plaintiffs offered in evidence as Plaintiffs' Exhibit 1, Patent No. 1,584,149, Patent No. 1,584,150, Patent No. 1,584,151, Patent No. 1,584,152, Patent No. 1,584,479, Patent No. 1,896,020, which were received in evidence and marked "Plaintiffs' Exhibit 1".

Counsel for Plaintiffs thereupon offered the following documents which were received in evidence and marked as indicated:

Certified copy of file wrapper, Patent No. 1,574,149, Plaintiffs' Exhibit 2.

Certified copy of file wrapper, Patent No. 1,584,150, Plaintiffs' Exhibit 3.

Certified copy of file wrapper, Patent No. 1,584,151, Plaintiffs' Exhibit 4.

Certified copy of file wrapper, Patent No. 1,584,479, Plaintiffs' Exhibit 5.

Certified copy of file wrapper, Patent No. 1,896,020, Plaintiffs' Exhibit 6.

THE COURT: These were not all on the same day.

MR. WHITCOMB: No, you are right.

THE COURT: The first five were all issued—

MR. WHITCOMB: Yes.

THE COURT: on the same day.

MR. WHITCOMB: Yes.

THE COURT: All right.

MR. WHITCOMB: And as to the last one we rely upon the fact that it was filed before the others issued, and as for common subject matter we contend for our right to go back to the early date.

THE COURT: All right.

L. S. ISHIMURA was called as a witness on behalf of the plaintiffs and having been first duly sworn, testified as follows:

Direct-examination.

By MR. WHITCOMB:

I am an employee of Nippon Denci Kabushiki Kaisha, which means Japan Storage Battery Corporation, of which Mr. Genzo Shimadzu, the patentee

of the patents in suit, is president. This company was organized in 1916, but I have known Mr. Shimadzu since 1906 and have been employed by him since 1906 or 1908 in the capacity of draftsman with the engineers.

In 1908, I was appointed by the Japanese Government as a student abroad here, and came to New York. I traveled all around and visited several factories, to see what the American Company does. That is all I did at that time. I took the mechanical engineering course at the Polytechnic Institute of Brooklyn and got an M. E. degree in 1916. After that I started to work for the Delavan Machine Company, making oil ranges, and for about four months thereafter I was with the Electro Galvanizing Company, Brooklyn, as a draftsman. In 1916, I went back to Japan and in October 1916 started to work with the Shimadzu Battery Corporation. I was head man in the Mechanical Engineering Department, and, of course, did everything for arrangement, the improvement of equipment, also made design of different kinds of batteries. I had contact at all times with Mr. Shimadzu, from whom I got instructions as to everything necessary to do, the most important thing to make some material for storage batteries.

MR. MORRIS: May it please Your Honor, may we object to any acts in the way of public use or any other acts done in a country other than the United States of America prior to a disclosure of the alleged invention of these patents or any of them in the United States?

THE COURT: Well, I will note the objection—

MR. MORRIS: Yes.

THE COURT: and take it subject to the equity rule.

MR. MORRIS: And may that objection stand throughout, without it being repeated?

THE COURT: Yes.

(The witness resuming testified):

Beginning with the year 1917 our company was buying oxide from other makers but the materials were not reliable, some times containing impurities and could not make good batteries, so Mr. Shimadzu wanted to try to make his own oxide factories, spending maybe fifty or sixty thousand dollars, but it is a very difficult thing to get ideal material for storage batteries so Shimadzu's original idea was to make better powder from metallic lead. He did not have in mind any apparatus but fortunately he had another company he was dealing with which had experience making the material for grinding china, stones, pottery industry work. Shimadzu had the idea of using apparatus used for pottery material. I can show you my notes describing experiments, what we used and everything else. This is a note I have written. I took notes day by day as the experiment progressed and here is one picture, we first used for experiment, from our office, where they were producing china wares, the most famous place in Japan, with a State research department for the pottery industry. They have machines and Mr. Shimadzu and I went through and borrowed a pot mill, around the middle of September 1917. This is the blue print on page 3 from the inside cover of this book which I have produced. To describe the operation of these pot mills, we placed the lead balls in, but the abrasion with the pot mill was too high, so that the balls just crushed each other and did not produce powder, except that the balls became covered with some black

powder, but there wasn't any sign of making powder. Next we tried many experiments with pot mills, changing the size and regulating the speed to see how we might produce fine powders. This was in September 1917. We made about 300 experiments beginning in September 1917 and continuing for about three or four months, until we got the correct ideas, including the use of a blast of air.

By THE COURT:

"Q. Were you correct when you said 1917? If you look at the book—

A. Well, pardon me, it is 1918.

Q. 1918?

A. 1918, yes, I am sorry."

The date on the first page of the book I have in my mind is September 1918 which is the year I started.

Besides the pot mills, we made wooden drums with "rumba" boards, which were temporary, of course, as we had to have the material as soon as possible. "Rumba" boards are wooden boards, just the same as for cement. These are illustrated by the blue print that is on page 7 of this book which I have produced (Fig. 3 of Pl. Ex. 7a).

The blue print between those two is of a porcelain made pot mill. It is like the first blue print but a different size.

(At the suggestion of the Court counsel for plaintiffs here offered in evidence the book produced by the witness, as to which the witness testified: This book was copied from my notes under my supervision. The first book was completed in 1919; the last one in 1921. I have had charge of the book ever since and it is in the condition in which it was when finished in 1919.

Counsel for plaintiffs thereupon offered in evidence a second book produced by the witness, whereupon the following discussion took place:

MR. MORRIS: May I make an inquiry, Mr. Whitcomb? Your exhibit—number 7, is it?

MR. WHITCOMB: Yes.

MR. MORRIS: — purports to cover what period?

MR. WHITCOMB: September 1918 to July 1919.

MR. MORRIS: And your number—

MR. WHITCOMB: 8.

MR. MORRIS: Proposed number 8, purports to cover what period?

MR. WHITCOMB: July 1919 to March 1921.

MR. MORRIS: All right. I will not take the time to examine them in detail now, if I may pass that to a later moment, and reserve the objection, general objection which I made a moment ago as to matters having occurred in Japan.

THE COURT: Yes, sure.

The books produced by the witness were thereupon received in evidence and marked "Plaintiffs' Exhibit 7" and "Plaintiffs' Exhibit 8" respectively.)

(The witness resuming testified):

We finally found a way of using the rotary mill so we would get some fine powder from lead. Then we finally decided to construct a machine in actual size and operate on a commercial scale. In order

that you may possibly see that our process can operate on a commercial scale, I have here a drawing designed by me September 24, 1918, and traced by me, ordered by Mitsushi Company which is directly over the first company, in October 1918. All writings, everything, was done by me, September 24, 1918, to show the actual success or failure of the apparatus, we wanted to try it out on a big scale. The two white sheets attached at the corner is the certificate which we ordered as to what we did during that time, endorsed by the Mitsushi Company and certificate endorsed by the American Consul as to dates, etc., which you can see. The date of the endorsement of the United States Consul is 1933. That is the original drawing.

Counsel for plaintiffs thereupon offered in evidence the blue print produced by the witness which was received in evidence and marked "Plaintiffs' Exhibit 9.)

(The witness resuming testified):

The date on that is September 24, 1918. It appears in the right-hand corner on the very last line and is in Japanese. The drum illustrated in Exhibit 9 has a small opening in one portion to discharge the lead powder. We got a very coarse grained powder containing metallic lead. There was no means for admitting air in this drawing. We did not use this in commercial production. The product wasn't good enough to use for storage batteries. It was not abandoned, but we got only coarse grained powder which could not be used for storage batteries, although we changed the revolutions and put steel balls in and adjusted the amount charged, and all kinds of things for many days. The amount produced was

very small, perhaps five, ten pounds per hour, so that the only thing accomplished was to get something that couldn't be used, at the rate of five pounds per hour. In batteries the material and constituents must be very fine, and one day Mr. Shimadzu noticed that at the top of the bearing somewhere a very fine lead powder accumulated. In some way the air carried the powder which accumulated just like dust. It was his idea to use air to separate the fine powder from the metallic lead existing in the drums. On December 25th, he ordered me to make a drawing of such a mill. I drew this (the witness produced a drawing) and Mr. Shimadzu got a notary public to attach a certificate so he can get back to the date of invention, December 25, 1918. This drawing was originally drawn by me and traced with my help by a draftsman. The red writing is mine.

(Counsel for plaintiffs thereupon offered in evidence the December 1918 drawing, which was received in evidence and marked "Plaintiffs' Exhibit 10. Whereupon the following discussion took place:

By Mr. Morris:

Q. Have you the exact date in December on it?

A. There is a date on there.

Mr. Shaffer: The date of that is December 25th, 1918.)

(The witness resuming testified):

This tracing is made on the 26th but originally the 25th according to the certificate. Must be 25th, my date here is the 25th (discussion off the record). The original drawing was made the 25th, the tracing on the 26th. The blue prints and the white sheets

are the same. The two white sheets are also prints of the same tracing as the blue print. There is no difference between the two white sheets and the two blue prints, except that the original drawing is dated the 25th and the tracing the 26th.

Q. I notice that this says down here at the bottim 9-12-26.

A. Original drawing dated 25th, the tracing was made the 26th, that is why man put 26th.

Q. Sure, but what does the 9 mean?

A. 9 is Japanese September, 9 is September.

Q. What does the 12 mean?

A. 12, 12 means December.

Q. What does the 9 mean?

A. 12th of December, 1926. It is a 7.

Q. 7?

A. 7—1918.

Q. How does 7—explain to the Court how the 7 means 1918.

A. Well, you see, Japanese has a different year, as Emperor changes, therefore, you might repeat two years, two different years, the name of the year, the same year. When Emperor changes we start new number 1, start with the first year. That is the former Emperor's seventh year. That means 1918.

Q. When did that Emperor start to reign in Japan, do you know?

A. Ten years, this says ten.

Q. Present Emperor started ten years ago,—

A. Yes.

Q. — in 1925, and then the Emperor—

A. Yes.

Q. — before that,—

A. Yes, before that, sure.

Q. — do you know when he started? When did he start?

A. I don't know, former Emperor, Taisho, that is pretty near sixteen years.

Q. What we are trying to get at is how accurate you are, how you know—

A. Yes.

Q. — that is 1918.

A. Just plus one, see, Taisho, the former Emperior, year plus one.

Q. How do you know when the former Emperor started? Do you know that?

A. Well, Taisho—this is Showa, second Emperor.

Q. I know, to get back to the other Emperor, the one we are talking about—

A. I swear Taisho 7 means 1918, exactly.

Q. In Japan do they use 1935?

A. Don't use—

Q. Do they use the same—

A. Don't use—ordinarily we use the Japanese order of years. This is tenth year.

Q. And that is what you have on these drawings?

A. The drawing always shows the Japanese years, that is why, I can tell you exactly the months and days correctly, but when it comes to translate into ordinary old years, you got to have sense, you got to come out exactly, but I am sure Taisho 7 means 1918. I can prove that, this is Taisho, you see, this is Taisho, seventh year, that is what I call 1918.

MR. WHITCOMB: The witness refers to Exhibit number 7, front cover.

By MR. WHITCOMB:

Q. And what does it say in Japanese?

A. Taisho seventh, seventh year of Taisho.

Q. And you say that that is 19—what, 1918?

A. Yes, plus eleven years, seven plus eleven years, give you your years, you have eleven years plus, always, that convinced me exactly, Taisho 7 means 1918. It is exact, no mistake about it.

Q. Well, then, to get back to this drawing, which you say is made in December, 1918,—

A. Yes.

Q. —showing the air going into the drum,—

A. Yes.

Q. — please explain fully, now, how this compared with the other apparatus where you had no air going in the drum.

I must state to you that before this thing came, we used an ordinary fan, we got using a tube. We then tried to blow air, but in this case we had very much trouble in separating the air and how to collect the powder. You have to know how much air and what size of fan, and during those days we had great difficulty in finding how to feed the air and everything. Without tube feeding air it is very hard to blow out the powder unless you use much amount of air and high pressure.

And we finally abandoned that experiment, and Mr. Shimadzu started to use tubes, so that you can blow the air current directly upon the contents and powders, so that the powder got to go out.

Q. You wanted to be sure to get the air on the material, is that right?

A. Yes.

Q. And what did you do about it, this drawing here?

A. Well,—

Q. December, 1918.

A. We had a tube arranged inside, main tube and nozzles provided, and sent high pressure air, maybe two and a half pounds pressure, that is quite a good

pressure, and so at the same time we regulated the amount we charged and the number of revolutions, so as to give good oxidation of the contents, then air blowing inside some way, so we had very good resu t, that is, blow out just fine powder.

Of course, we had many difficulties, how to correct it. I can—I can tell it very in detail, but you can imagine how hard it was, in Japan, making this product, the amount of air, to separate the powder coming through, and you have to use some air to separate and collect it.

We had a drum in October, 1918, without any pipes. In December, we made this drawing with the pipes and continued to experiment. I made a drawing and Mr. Shimadzu's company made this part. Mr. Shimadzu has a machine shop where things can be made very quickly. You can see from the English translation of this exhibit how we proceeded.

Mr. Shimadzu told me to put in the pipes. All this work was done under the instruction of Mr. Shimadzu because I was employed by him and he supervised me in every way. We had the drawing done with the pipes in so you could put the air in December 25, 1918, when that drawing was made. Mr. Shimadzu then obtained a notary public's certificate. The apparatus was finished about March, 1919. It was exactly like this drawing, except that the drawing does not show the branch pipes. The branch pipes are shown in the drawing on page 5 of Exhibit No. 8. I do not have any large drawing like Exhibit No. 10. When Shimadzu told me to make it, I made it like this small drawing in the book, with short pipes. The apparatus that I am talking about was completed in March, 1919. We operated this machine with the air in various ways, adjusting the air pressure and amount, measuring the specific gravity of

the product, and what constituted it, by all sorts of experiments, continued a very long time, in order to find the correct amount of air going through, and what kind of powder we need, and all that sort, you know how difficult it is to get ideal material for storage batteries, it is the most difficult thing to do, especially the maker who is trying to get their own materials.

Q. What was accomplished by the introduction of the air, broadly, as compared with the previous apparatus where you said you had no air and got practically no material, and what you did get was no good?

A. Well, original idea was to get finest material from mills, with coarse material stayed in the material, just blow out fine material, so we can use batteries, that was the idea, but later we found the amount of product increases tremendously, after sending the air in.

Q. What was that due to, do you know?

A. Well, found oxidation was taking place.

Q. At first you thought you just wanted to blow the material out?

A. Yes.

Q. But when you found a tremendous oxidation took place, is that it?

A. That is right.

Q. And what happened?

A. Well, as the temperature go up, that means the lead when heated up to critical temperature becomes very brittle, and when you have oxidation present, also surface becomes very oxidized, so brittle you can scrape it very easily, produce fine powder, that was found, also, and under good conditions, this is the most ideal thing to do.

We tested it once to see what we would get without using any air. In that case we operated the machine nine or ten hours and obtained only a polished surface. There was not the slightest evidence of making powder. Here is a picture which shows how that thing looks. (The witness produced a picture.) The balls themselves got smooth and shiny but produced no powder at all after seven hours. The book that I produce is a summary statement of the tests of what we have done. It was made in Japan. It is written in Japanese. It shows what we have done and represents Japanese work. This one was published in March, 1924, there isn't any mistake, although it is very hard to see right away, because the Japanese had their own years.

(Counsel for plaintiffs thereupon offered in evidence the catalog or compilation of results referred to by the witness. Whereupon the following discussion took place:

MR. MORRIS: I am wondering whether the books should go in evidence.

THE COURT: Well, I don't believe it should, but I think there is no objection to putting the picture in evidence.

MR. MORRIS: That is what I was getting to, the book seems to me to be objectionable for two reasons, because, first, it is in Japanese, without translation, that is, I assume that it is Japanese, and the second is that it is probably not pertinent. I have no objection to the picture.

THE COURT: That is really all you want?

MR. WHITCOMB: That is all.

THE COURT: Nobody is going to translate that. It will be received for the purpose of the picture.

MR. MORRIS: That is, I have no objection to the picture, outside of my general objection.

THE COURT: Sure.

The compilation of results produced by the witness was accordingly received in evidence and marked Plaintiff's Exhibit 11.)

(The witness, resuming, testified):

We wanted to get air in there to get oxidation, but it isn't easy to control the temperature of lead and moving air, that is, the oxidating agent. There has to be a critical way to control it so that you get the best product and largest quantities. We made many experiments to ascertain some of these facts, as these books show. In that way, it was possible to see how much air had to put in, and what the best rate of speed was inside the mill, and what the air and what temperature was required. All of these facts are very important to produce the ideal material in the largest quantities. That is why we were working hard for years and years. We made about three hundred experiments, written in this book, which shows all the curves, specific gravity, production, and peripheral speed. I am referring to the first book, Plaintiffs' Exhibit 7, including a whole list of tabulations on several pages, each of which represents one of about two hundred experiments. The curve represents results at different speeds and specific gravities and production amount, showing that with ideal peripheral speed you get maximum production. Of course you have to control temperature

and what you have in the mill. These things show what was done so as to get the maximum production under all conditions.

With respect to peripheral speed, the results of our tests show that at low speed the lead would cascade, slide down, in a mass. At greater speed the contents rise to the upper part of the mill and fall down to the bottom part, that is, strikes the bottom of the drum so that there would be no powder producing effect or friction effect. You have to have just enough peripheral speed so that all pieces of lead have individual motions.

Mr. Morris: I beg your pardon, just a moment, I wonder if I can have the answer to that read?

(The answer was repeated by the reporter, as follows:

"A. Well, at low speed your lead would cascade, slide down, in a mass.")

By The Court:

Q. Does that mean the powder, you mean?
A. Contents.

Mr. Whitcomb: Means it would rumble down, just slides and does nothing.

The Court: All right, go ahead.

(The answer was continued by the reporter, as follows:

"A. At a greater speed the contents raises up to the upper part of the mill and falls down to the bottom part" . . . "strikes the bottom of

the drum, so that there would be no production, powder producing effect or friction effect.")

By The Court:

Q. Well, why wouldn't there, at a high speed?

A. Because inside the mass turns up with the mill, and it is at relative speed of drum and the inside mass changes, so instead of going with the mill it falls down, at a certain speed.

Q. Do you mean if you rotate at a high speed the centrifugal force would simply keep it plastered—

A. Yes.

Q. — against the sides of the drum?

A. I am not talking excessive high speed, that means everything, centrifugal force, it sticks.

Q. I see.

Mr. Whitcomb: Well, he is talking at a fairly high speed in which they would come up and just drop down in one lump in the middle.

The Witness: Yes.

By Mr. Whitcomb:

Q. It would fall in the free area in the middle of the drum and not hit other balls?

A. Excessive high speed?

Q. Not excessive, intermediate, fairly high speed.

A. Well, that is the reason the size of the mill and the revolutions is so important in this case.

By The Court:

Q. Well, I know, but this is what I want you to tell me, why don't the balls abrade and make powder at a high speed?

A. Not high speed, just enough speed.

Q. No, but why don't they do it, if you get it too high?

A. Too high—

Q. What happens if you get it too high?

A. Well, too high means some part of the product fall down and hit the bottom, and makes a noise, and gives a very—crushes the lead into pieces in some way.

Q. Well, but that is what you want.

A. Makes coarse grained powder if you have—

Q. But it will break up the lead?

A. Yes, break up the lead.

Q. But it will make it too coarse, is that the idea?

A. Yes, too coarse.

Q. It won't make powder, it will make chunks?

A. That is right, you might get free lead, pieces of lead.

By Mr. Whitcomb:

Q. Flakes, is that what you mean, flakes?

A. Yes.

The Court: I guess I understand that.

The Witness: As far as speed is concerned, you have to have proper speed so it agitates every individual piece, has individual motion.

The Court: It will shatter the lead rather than just abrade it.

Mr. Whitcomb: Yes.

The Witness: We tried very hard to see what the motion of the contents does, according to the speed of the mill, according to the peripheral speed, and found exactly what is the most

ideal speed for certain conditions. That was a very important subject.

By Mr. Whitcomb:

Q. What was the speed for your drum?

A. Well, ideal speed is, sixty inch mill, about forty, and you can start with twenty, twenty-four, twenty-five, most good speed is just about around forty, sixty inch mill, sixty diameter mill.

Q. Sixty inch, you mean?

A. Yes.

Q. Now, take the question of temperature, what about that? You say you went into everything.

A. This is also a very important thing. Ordinarily, when you cut and expose metallic lead, a gray film will appear in a few days. This is the lowest kind of oxide, which may be called lead suboxide. Under ordinary room temperature, this oxide does not change any more, according to the theory of equilibrium. But when the temperature changes and any oxidizing agent is present, an extraordinary change occurs, according to the temperature. So that, if you take the surface off and collect it you might find pure metallic lead powder and some of the so-called Pb_2O, suboxide.

By The Court:

Q. The point is this, that if you expose a lead surface to room temperature you will get a certain change?

A. Yes.

Q. But it won't increase, it will just stay at that point?

A. Yes.

Q. It will be a low oxide of lead, but if you do the same thing and raise the temperature—

A. Yes.

Q. — then you will get something else?

A. Yes.

Q. Now, what Judge Morris and I want to know is what that other thing you get is.

A. Well, get—get more amount of low—lowest stage of oxide.

Q. You get more amount of a lowest stage of oxide, is that right, and less of the metallic lead?

A. Yes.

There are two kinds of oxide. Up to 270 degrees Fahrenheit, you may not get yellow colored PbO. But above 200, somewhere around 270 degrees Fahrenheit, you will have yellow colored so-called litharge, PbO.

Q. So-called litharge PbO. Well, then, please go ahead and explain to the Court, when you accomplished your best experiments, say in the spring of 1919, or whenever it was, I understood you to say some time in 1919, what product did you get?

A. Well, we were just getting about the same product at the present time, very major portion of PbO, colored black; a small amount of Pb_2O and other oxides of lead, PbO, yellow color.

Q. What went on in the drum, do you know, in this, what happened in the drum?

A. You see, the principal reason, lead never goes into higher oxides directly from metallic lead, metallic lead to the higher oxides, that is, lead in the heated drum with the oxidation gas must pass the lower oxidation stage.

By Mr. Morris:

Q. Must what?

The Court: Must pass through a low oxidation stage.

By Mr. Whitcomb:

Q. Must first form Pb_2O?

A. Therefore, you can estimate the powder product you are making in the drum. The first thing is a black product which may be finely divided metallic lead, plus black colored PbO, or entire suboxide. This material is very hard to analyze, but I am sure that this original low stage of oxidation fills up the drum first. Then according to the control of temperature, you oxidize further any way you want, according to controlling temperature. That is the way Shimadzu makes all kinds of products.

Q. Did the lead suboxide formed pass on to, entirely to lead oxide, PbO?

A. No, according to the molecule construction, sometimes remains.

Q. Molecule construction?

A. Associates, or remains again suboxide, you can't tell this, very delicate, according to the temperature and amount of air, it is difficult to tell, but you know there is a certain mixture there, see, to make things balance, but, of course, you expose the material, you have more air, or moisture, but inside of a drum you have a certain low kind of oxidation.

Q. How was the metal formed, the metal powder?

A. You mean metallic powder, metallic lead powder, when it comes to ideal temperature and grinds finer, that is the finest product we ever had as far as metallic lead is concerned.

Q. How is it formed?

A. Well, you know, lead when heated up, certain temperature, becomes very brittle, and when you scrape the outside part, naturally you are scraping off some metallic parts, that is, finely divided metallic lead, just as suboxide or other lowest oxide. I can

prove this, because in the market, you have lead powder in the market, and you see that burns in the air, and except you are testing with a chemical reagent you don't tell, you can't tell what metallic lead or suboxide is.

Q. Well, does the suboxide break up?

A. Very easily.

Q. Into what?

A. Into the smallest grain you ever know, just little.

Q. What are they, grains of what?

A. We don't call grains; so amorphous, so fine, just like a liquid.

Q. Well, what are its chemical constituents when the suboxide breaks up?

A. Well, you have the pure metallic lead and the PbO.

Q. Then metallic lead is formed from the PbO, is that correct?

A. Exactly.

Q. And that is this very fine powder you are talking about?

A. Yes, the finest part.

Q. Could you get it that fine by the chipping action of the balls—

A. Yes.

Q. — themselves?

A. Yes.

Q. Wait a minute, you mean to say you can make it so fine just from a mechanical chipping?

A. Well, that is our essential, most delicate part of the thing we ever found.

Q. Well, I am asking you—

A. Yes.

Q. — what you got, the finest metallic lead in your substance, how did you get that?

A. Well, it is contro ling temperature and the way you supplied oxidation agent, air, for instance, and to get nice, harmonious action.

Q. Sure, but what does this harmonizing action—

A. To do that you have to know the amount to charge, temperature, air, and the speed of the mill, all kinds of things, you got to watch out, not incidentally, you couldn't do it.

Q. Well, is it possible to grind the balls themselves so that just grinding would give you that very fine? I thought when you first testified you said the early drums were so coarse.

A. Of course, that is true, because you haven't got enough temperature to deal with it.

THE COURT: Oh, well, I understand what he wants to say,—

MR. WHITCOMB: All right.

THE COURT: — and what you want him to say, and everything about it.

After we had a successful drum working, we next tried to make batteries from the new oxide. We made many experiments to produce batteries of more capacity and longer life. The Shimadzu companies, or the companies with which he was associated, had previously been making batteries. They bought the oxides. Now, with this new material, we tried to make a battery plate. We had difficulty, however, because this is entirely new material and we tried to find how good this material was for storage batteries.

Very fine powder is essential for the pasted type of batteries because coarse grained lead powder always contains a certain amount of metallic lead, which makes it unfit for the pasted type of battery.

By Mr. Whitcomb:

Q. Do you know why that is?

By The Court:

Q. What are the two plates made of, now?

Mr. Whitcomb: They eventually come to lead and lead oxide, Pb and PbO, after you get it worked up in a battery, but in both cases you start with this mixture.

The Court: Yes, I understand, but what do you get finally in the battery plates? There are two different kinds of paste you use aren't there?

Mr. Whitcomb: No, you use substantially the same plate, isn't that right, same material?

The Witness: You could use same material.

The Court: I thought the alternate plates were somewhat different.

Mr. Souther: The alternate plates, lead peroxide in the positive plate, and spongy lead, pure metallic lead, in the negative plate.

Mr. Whitcomb: We are going to have a witness on that.

The Court: I understand, I just wanted to get that straight. All right.

The Witness: But you can use same material for both positive and negative, only formation stage, the action changes into peroxide, and the other one, spongy lead.

The Court: All right.

By Mr. Whitcomb:

Q. When did you make the material that would be satisfactory? You said you ran this drum in March or April?

A. Well, during that time Mr. Shimadzu wanted very seriously to make excellent batteries, so we all engineers worked very hard, and finally we found this new material, the most ideal thing for storage batteries.

It is characteristic of this new material that it is so fine that it burns in the air, spontaneous oxidation takes place and there is violent action. When mixed with sulphuric acid or water and pasted into the grid of electric storage battery plates, the ordinary material, wet and dry, usually cracks, because of shrinkage of the material between the grid and the pasted parts, but with this material, lead hydrate forms and expands the volume so that it compensates for what shrinkage takes place. We found that there is no more buckling or cracking. That is disclosed in Shimadzu Patent No. 1584479. Lead hydroxide is the same as lead hydrate, which is referred to in that patent.

With respect to the drums, the particular mill that was made in April, 1919, was used for commercial production right along. Some of the setup in the plant is illustrated in my report Plaintiff's Exhibit No. 8, at page 24 (Fig. 28, Pl. Ex. 8a). That shows the worm-drive and how to feed the balls into the mill. That is the production mill. (The witness here referred to a book handed to him by counsel.) On the last page in the book is a picture of the machine as installed in the plant some time in June, 1919.

(Counsel for plaintiffs thereupon offered in evidence a picture of the installation in the book, which was received in evidence and marked Plaintiffs' Exhibit No. 12.)

In the particular installation illustrated in Plaintiffs' Exhibit No. 12, the air is forced into the mill through the feeding ~~mouth~~ on one side and discharged at the other end. Sometimes we have had a suction fan. The machine can be operated both ways, pressure system or suction system. In case the air is to be used for oxidizing in the drum, you have to change the way you send in the air current. You cannot operate the apparatus by suction only. You have to have the pressure fan through that so that air goes through the tube provided in the mill, and then you can have the suction fan. I am talking about a mill that provided tube nozzles. A mill without them can be used both ways.

(After recess, the direct-examination of the witness continued as follows):

In the last question, I referred to the use of a drum without the pipes but using the air. I stated it could be used both ways. The first time we just sent the air by means of using the fans. Now that we have the mill in operation, and used the fans with the tubes, we can also use the air without the tubes.

Q. Please explain in detail what—did you make any distinction on the grounds so far as the oxidation—take the oxidation first—is concerned?

A. Well, according to the amount of lead pieces in the mill, where the air is blown, if you haven't got no tubing, it is difficult to force out all powder formed in the mill.

Q. Do you force out some?

A. You can, but just about finest powders only.

Q. I tried to exclude the idea of forcing out, I asked the question as connected with the oxidation process going on. That does not make any difference in connection with the oxidation, is that the answer or not?

A. Well, I was just talking about what the air does.

By The Court:

Q. I wonder if this is what you mean, as far as the oxidation goes, can you do it just as well without the tubes as with it?

A. Yes. I am talking about the method of using the tube or not.

By Mr. Whitcomb:

Q. In my question prefer to forget about using the tubes. What actually happened when you did not use your tubes but used the air?

A. It is a little hard to blow out the product unless you add extraordinary amount of air.

Q. How about the oxidation, is that satisfactory?

A. Oxidation takes place just about the same.

Q. This morning you mentioned a temperature of two hundred and seventy degrees, but I understood that that was more or less when you began to get the oxidizing action. What would you say was the satisfactory temperature at which you were operating when you got your best results, early, we can just say, in the spring of 1919?

A. Well, making the most excellent production for unit, weight of unit, you must control the temperature at nearly 270 degrees. You produce the best amount of black powder at that temperature. If you want to oxidize more, you can maintain it longer,

and increase the temperature a little higher, as desired. The upper limit in the temperature is about 200 degrees Centigrade, as we estimate.

With respect to the effect of the air on the temperature, the horse-power put in is converted into heat, which causes the temperature to go up and results in a tremendous amount of oxidation. The air not only oxidizes and discharges the product, but cools the machines so that you can control the temperature. The air has the effect of cooling the top temperature. It is very important in this process.

I know that Shimadzu got patents in the United States, as far as these developments which I have detailed are concerned. Those are the patents in suit. I have read them. I have charts showing the type of apparatus that would be used in the first patent, No. 149. (The witness examined a chart.) This chart illustrates what the specifications describe. You have a revolving drum, and on one side you have feeding hoppers.

(Counsel for plaintiffs thereupon offered in evidence the chart referred to, which was received in evidence and marked Plaintiff's Exhibit No. 13.)

Then for providing the tubes, there are a number of holes, so that the air can blow through and blow out powder from one side of the cylinder opening, blow out the powder collected by means of dust catchers, by separation means. These notes I have written on this chart are exactly worded from the Patent No. 1584149. I have a similar chart for Patent No. 1584150.

THE COURT: What is the difference in the wording?

MR. WHITCOMB: You have accurately the language in the patent, he has followed similarly, generally everything generally similar, but presence of pipes in the second patent, he used pipes plural, he put on several pipes. Then there is a reference to a cooling apparatus used which is operated to cool and further control the temperature, so he illustrates the conventional form based on the wording of the specifications. Otherwise, there is very little difference.

(Counsel for plaintiffs thereupon offered in evidence chart on the 150 patent, which was received and marked Plaintiffs' Exhibit No. 14.)

I have a chart illustrating the 151 patent.

(Counsel for plaintiffs thereupon offered a chart in evidence, which was received in evidence and marked Plaintiffs' Exhibit No. 15.)

The foundation for the drawing in each of these charts I found in the wording of the specifications.

Shimadzu got patents in almost every foreign country which has patent laws. He got them in Germany. In connection with obtaining patents in Germany, we had some hard difficulties.

MR. MORRIS: If the Court please, it seems to me that that is not pertinent, and I object.

THE COURT: Well, it may not be, but I will take it subject to your objection under the equity rule.

THE WITNESS: We had some objections from certain parties in Germany to the granting of the principal patent, the Tudor Company. I have a copy of the patent proceedings. This is the translation of the government file from German

into English. I have the original German in my office in New York.

(Counsel for plaintiff thereupon offered in evidence the file of the German opposition proceedings, which was received in evidence and marked Plaintiffs' Exhibit No. 16.)

The Tudor Company of course is a very powerful company as far as the battery business is concerned in Europe, and they produced material witnesses and showed by practical operation and drawings how to make batteries, but we finally won the case. The higher court of the German Patent Office granted the patent to Shimadzu because they found it was a patentable application. The invention involved in that patent application was exactly the same application we had in the United States. The essential reason for the allowance of the patent to Shimadzu was that Shimadzu utilized the most important medium of oxidation, air, and what air does the German Tudor Company never can. I mean the cooling effect. You will find the cooling effect referred to in the German record, and what the air current can do with respect to the oxidation condition.

The operation of the mill provides that temperature that I defined this morning. I stated that the cooling effect was to keep the temperature the ideal way as desired. The lower limit was sixty degrees Centigrade. Up to sixty degrees Centigrade, you would get oxide of lead. The file wrapper I have introduced, showing the drawings of the Tudor mill operation, shows the construction, dimensions, working, everything.

With respect to Mr. Shimadzu's patent rights in the United States, negotiated with several companies

to dispose of such United States patent rights. When I was in Germany at the beginning of 1926, Shimadzu cabled me to come to New York and go down to Philadelphia to see Mr. Cary, Vice-President of Leeds and Northup Company, and I went to get in touch with him, to see what he knew about negotiations of oxide processes and dispensary. Mr. Cary went to Japan some time in 1925. I know, because he disposed of his sales agency in Japan. Mr. Cary went to Mr. Shimadzu's company's office and met Mr. Shimadzu, and while he was talking about his agency, Mr. Shimadzu told him about the lead oxide business. I was then in Germany. I met Mr. Cary in Philadelphia in June, 1926. Cary told me that he had a friend and he arranged to introduce to me those Exide people. The same afternoon I met the Exide people and explained this new invention in detail. Then started negotiations, and, of course, the Exide people knew most of the story through Mr. Cary. I understood that the Exide people were very much interested in our process. They went in the conference rooms and they gave me different answers. A few minutes later they came back and President Lloyd told me that we should provide terms for disposing of our rights in this process. He told me that personally. That was at the very first meeting. Meanwhile, I went down several times. Also we had meetings twice in Marks and Clerk's office in New York about this patent business. I went down to Philadelphia several times. The second time I went down I met Mr. Lloyd, Mr. Stoughton, I did not see Mr. Stoughton every time I went down—well, no others were there whose names I know. I met Mr. Smith some times. I went also to Marks and Clerk's office in New York Mr. Parker was there. Their business was the sit-

uation of American products. I have copies of the investigation of the patent standing.

THE COURT: Are they lawyers?

MR. WHITCOMB: International patent lawyers is what they are.

THE COURT: All right.

Nothing very serious happened at Marks and Clerk's office, except that we agreed to consider this matter further, that's all. Mr. Stoughton was there, Mr. Hall, Mr. Stoughton and myself, and Mr. Parker. This took place in August, 1926. The patents had already issued in May, 1926. We had two conferences at Marks and Clerk's in New York of that nature that I remember. The upshot was that they told me the matter should be further considered. That is the last answer I had. Meanwhile, we submitted contract papers. We haven't got them back yet. Of course, we didn't discuss the exact terms because I was awaiting instructions from Mr. Shimadzu at that time. I haven't got a copy of that paper at the present time. I gave the paper to President Lloyd.

MR. WHITCOMB: Counsel for plaintiffs would like to call upon counsel for defendant to produce the paper referred to by the witness.

THE COURT: That is the form of contract that was submitted.

MR. WHITCOMB: And he never got it back he said.

MR. MORRIS: I will look and see if we have it. I cannot answer at the moment.

We referred in the contract to a lump sum payment.

In connection with dealing with Exide, I had a legal power of attorney from Mr. Shimadzu's company. With respect to these conferences I have never heard anything since the last day, we met in Marks and Clerk's office. I had some important work to do and I went back to Japan. I went back about October of 1926. Early next year we had notice from the foreign office that United States patent was involved in interference with the application of Mr. Hall, the engineer of the Exide Company. (The witness here examined a paper.) The Hall application was dated in regard to the Hall patent cited in the answer to this suit. This patent is No. 1,888,823.

Q. What was the outcome of the interference?

MR. MORRIS: I wonder again if the witness should draw a conclusion by the outcome of the interference? That should be shown by documentary evidence if it is pertinent at all.

MR. WHITCOMB: Question withdrawn.

THE COURT: What was the result of it? I am interested in it, can somebody tell me?

MR. WHITCOMB: Priority was awarded to Shimadzu on two grounds, one of the opening—

THE COURT: Never mind about that, what I want to know was Shimadzu—

MR. WHITCOMB: He was the winner, in the vernacular.

MR. MORRIS: Well, couldn't—I am sorry.

MR. WHITCOMB: We will get into that later. I would like to introduce the—

THE COURT: That was in the case before, but I had forgotten it.

MR. MORRIS: One of the grounds was that Hall did not have suboxide, nor—

MR. WHITCOMB: And the other was the dates and invention. Remember the arguments at the hearing?

THE COURT: Yes.

MR. MORRIS: Hall had priority to the claim sought, but he had no dates for the substance which they contended he did not have.

THE COURT: Yes.

MR. WHITCOMB: Your Honor, could we have a minute's recess? We think we have got a copy of the letter they are talking about.

THE COURT: How much time do you want?

MR. WHITCOMB: Five minutes.

(A five-minute recess was taken.)

Counsel for plaintiffs thereupon offered in evidence the file wrapper of U. S. Patent No. 1,675,345, which was received in evidence and marked "Plaintiffs' Exhibit 17". The file wrapper of patent No. 1,888,823 was also offered and received in evidence and marked "Plaintiffs' Exhibit 18".

(The witness resuming testified):

I was keeping in touch with Mr. Cary. As soon as I arrived in this country I had a letter from Mr. Cary describing what was going on. He gave me a copy of a letter which I can produce. This is the one (the witness here examined a letter). It shows Mr. Cary's letter from Mr. Smith. This was writ-

ten by Mr. E. W. Smith to Mr Cary, vice-president of the Leeds and Northup Company. It is dated May 13, 1926. Mr. Cary showed me that and gave me a copy. This is the copy he gave me.

(Counsel for plaintiffs thereupon offered in evidence the letter produced by the witness which is dated May 13, 1926, written by Mr. E. W. Smith, factory engineer, to Mr. Cary; which was received in evidence and marked "Plaintiffs' Exhibit 19".)

He was referring, by the United States Patent Office, to the fact that they did not take any license under these patents because these parties were involved in the interference against our petition. That is the last I heard of it.

In 1928 the U. S. L. Battery Corporation took licenses in the United States under these patents. There was a license. It has been in force since 1928. Payments have been made to the extent of 25% of the profits, that means pretty near forty thousand dollars a year. Twenty-five per cent. of the profits is forty thousand dollars a year.

Licenses have been taken out in England and France under a number of British and also many French patents relating to making the product for material for storage batteries and also oxides. The same kind of patent broadly, which I was talking about this morning. We got patents all over the world at about the same time. We got a series of patents, several of them in this country and several of them corresponding to each other. We got them in the other countries.

References to the issuance of the Japanese patents were published in "Chemical Abstract", issued

in this country. I have seen the issue of May 10, 1924 which shows all details of Shimadzu's Japanese product, translated into English. Five or six patents were referred to in the same issue of May 10, 1924 of "Chemical Abstract" at page 734.

I know that a notice of infringement was sent to the defendant in this case with respect to these patents. Notice was sent claiming that they had infringed on these patents. That was handled by Judge Newton. He consulted me and he said it was the proper thing to do. I don't know exactly when he did send it. I have a copy but not here. I know it was done.

Cross-examination.

By Mr. Morris:

With respect to the balls appearing on page 70 of "Plaintiffs' Exhibit 11", lead balls were rotated seven hours without giving one pound of powder. We got no powder. Actually, we don't use balls, we use lead pieces. We have not used lead balls for several years. We got no powder. But the pieces got rounded like that. We were not operating with air. Carbon dioxide passed through at that time. Those balls stayed at just about room temperature. Our R. P. M. was about twenty to twenty-five. The drum was sixty inches. It operated at a peripheral speed of about 470 feet and remained at room temperature. There was heat friction but it did not increase the temperature by much. Our load was not more than one thousand pounds or so. We had a thermometer in that mill around that time. There was a little variation in temperature but we were using carbon dioxide. There was no oxidation heat just a little heat from friction, but the balls were so

brittle that there was no friction. Consequently, the power consumption was very small. There was no heating going on. Our other mills operate under different conditions. You do not necessarily have to have oxygen present in a free state in order to get heat from friction. If you have some oxidizing gas present you may have more heat from oxidation. You must remember that the material passes through the carbon dioxide not over the air.. You pump the carbon dioxide into the drum. We ourselves simply introduce the carbon dioxide into the drum. That prevented any heat from friction except for a little, because the metallic surfaces are very smooth.

I am an engineer. Oxygen is, of course, essential to the production of heat from friction, but you have to have enough friction. Whether a rotation of twenty-five revolutions of a drum having a diameter of five feet, a load of one thousand pounds and chunks of lead will produce no heat from friction, depends upon the nature of the experiment. If it is passing through carbon dioxide, it is operating under entirely different conditions and circumstances. According to our experiments, passing through carbon dioxide, there was no heat raised. The temperature was not increased to any extent. We had thermometers present. We kept a record of that experiment. It is in the Japanese records. It is in the Japanese exhibit. Here it is (indicating page 69 of the book containing plaintiffs' Exhibits 11 and 12). I am sorry I cannot give you the thermometer readings. These things were done 15 years ago and I cannot remember The things I am pointing at tell of sending in the carbon dioxide into the mill. I am reading here (indicating). "Table 49, test No. 96. Time is 9:14, 4:14: seven hours. Revolutions 38, and we retain that

Lead pieces, 750 kilograms." I don't know exactly how much that would amount to translated into pounds. "Temperature inside of room, sixty-eight, Centigrade; inside the drum, seven to thirteen centigrade; out of the drum, seven to thirty-one. That shows the temperature don't go up." The highest temperature we found in the drum was thirty-one degrees Centigrade. That is something like eighty-eight degrees F. This operation was conducted some time in the winter in the year 1919. The highest temperature I read was sixty-eight degrees F. We had two different temperatures. The highest Centigrade is thirty-one. That is on this page (indicating). The test there (indicating) is the rotation of the lead balls. We had 750 kilograms. This thirty-two degrees is just the room temperature. Six to eight is the room temperature. This thirty-two is the temperature of the carbon dioxide gas coming out. The left temperature was thirty-two degrees Centigrade. This is the temperature outside of the drum. The thermometer was attached somewhere outside of the drum, just outside of the contents.

We did not get any powder because there was no oxidation. If you have no oxidation you cannot get any powder. Unless you have oxidation you cannot get any powder.

There is not exact correspondence between the United States and Japanese patents. I would not say that they were exactly corresponding because the Japanese is entirely different from the English. You cannot get exactly the same, that is, a word by word translation. I do not know whether there are Japanese patents for the invention described in United States patent '149 in suit. I don't know anything about those patents anywhere. I cannot say exactly what are the patents in Canada that corre-

spond to the patents in America. We have just about the same patent, the same application. I know that there are patents in these foreign countries, but I don't know exactly the number and when it was gotten, and things like that. I knew that they were corresponding patents because the maker of the invention is the same and the improvements are about the same. That applies likewise of course to the patents in Japan.

Plaintiffs' Exhibit 13 was made up a couple of weeks ago, I think, by the assistant to Mr. Whitcomb. That applies also to Plaintiffs' Exhibits 14 and 15.

By Mr. Morris:

"Q. Now, then, will you tell me what year the experiment was made with respect to the lead balls that we were talking about before the recess, in here?

A. You mean starting of the experiment?

Q. No.

By The Court:

Q. No, no, what year did you make that experiment that you got that picture from in exhibit—

Mr. Morris: Exhibit 11.

A. Some part of—winter of 1919.

By Mr. Morris:

Q. The winter of 1919, you mean perhaps November, December, January, February, what?

A. Must be winter, because room temperature is 7 degrees Centigrade.

Q. 7 degrees Centigrade?

A. Yes.

Q. And that is only 44, 45 F., isn't it, so that

might have been November, December, 1919, or might have been January, February or March of 1920?

A. Exact date, it isn't said in this book, it is so long ago I can't tell you exactly.

Q. Was the winter of 1919 any colder than the winter of 1920?

A. I can't tell now.

Q. So you are judging the date solely by the temperature, are you?

A. No, see, the room temperature, about 7 degrees Centigrade, in some way.

Q. Yes, but it would be approximately that same temperature in the winter of 1920 or 1921, wouldn't it, also 1905, or 1906.

THE COURT:

THE COURT: No, but he is talking about something different, he is talking about the month.

By THE COURT:

Q. Now, how do you know that the year was 1919?

A. I don't think we conducted, did this test—

Q. Does the book give the date? Does the book give the date?

A. This is a summary of the whole thing, written in 1924.

Q. I see.

A. So these tests were done way before.

Q. Well, all right, then, then the only thing you can tell from the temperature was, it was the winter. How can you tell what year it was? How do you know now what year it was? You say it was 1919; how do you know that?

A. Well, after we—

Q. Now, wait, turn over this way so I can hear.

A. This present operating condition, we didn't

test no more, this was before 1920 or 1921, and where we found what air does was the end of 1919, to '92 or '91—1921, so must be along that period.

Q. In other words, this experiment was finished before you started with the air, is that right?

A. No, after we started air and everything else, before we established the normal operations of the mill.

THE COURT: Well, all right.

By MR. MORRIS:

Q. And your air was in 1920 and 1921, and this was before the air?

A. No, no, after the air, see what, to find out what the air does.

Q. But I understood you a moment ago to say that you stopped experimenting after you found out what the air did, was that right?

A. Well, I don't get you exactly, what you mean.

Q. Are there any dates in this book, Exhibits 11 and 12, to show anything about the year in which it was conducted?

A. No, this is a summary—

Q. Well, the answer—

A. — of the tests.

Q. — is "no", then, is it?

A. Tests done up to March, 1924.

Q. Is there anything in this book to tell you in what year that experiment—

A. You know,—

Q. Do you know how to say "no" or "yes"?

A. No, the book don't tell you the exact date of the experiment.

Q. Is there anything in that book to tell you whether that experiment was in 1919?

A. Well, all the experiments done since 1918, don't classify, the experiments done, certain date.

By THE COURT:

Q. No, but now, then, Mr. Ishimura, he is asking you a plain question, you ought to be able to answer that, is there anything printed in that book which shows that that experiment was done in 1919?

A. I think there is.

Q. Well, now, will you show it to us? What is there that shows that that experiment was done in 1919? That is what he wants to get.

A. Well, exactly there is no description, but my recollection.

By MR. MORRIS:

Q. There is no description in the book, but it is your recollection?

A. Yes.

THE COURT: That is all.

By MR. MORRIS:

Q. Then there is nothing in the book to tell you that that experiment was conducted in 1919?

A. But I am not so sure.

I did not make the drawing, Plaintiffs' Exhibit 13, myself. I have no idea who made that or how it was made. It was done by just ordinary engineers who drew it from specifications.

In a drum rotating fifteen, twenty-five revolutions a minute, the drum being sixty inches in diameter, you do not have a vacuum condition, you have oxidation all the time. This cooling device for heated air to go off is necessary for the reason that when you have sufficient air pass through the mill naturally oxidation takes place. That means a tremendous amount of heat, oxidation heat, develops. If you don't send in enough air to cool down you naturally

have to have some means to cool the mill so as to keep down your temperature normal. In this drawing number '150 patent, we are sending through about five hundred to seven hundred and fifty cubic feet of air per minute. The patent didn't describe that. According to the patent, enough air is sent through the drum to impinge upon the contents in the drum. I does not seem as though it does impinge in '149. The air is just passing through. According to the pressure, of course, it might impinge. I am not sure whether it would impinge at a pressure of two pounds and a half per square inch. The pressure provided for in '150 patent is just about two pounds, two pounds and a half. I do not find that in the patent. I know that no value is specified in '150. I don't think that there is anything about air volume in patent '150, but the way it describes certain pressure indicates a certain pressure, where it is stated that the air impinges. It doesn't say anything about pressure. '149 patent does speak about a pressure of two and a half pounds. You cannot convert that into volume. You cannot tell about the volume but in each there is enough volume of air to blow the dust out. As illustrated in Plaintiffs' Exhibit 14, the air would be sufficient, introduced into the drum, to blow the dust out immediately after formation. It is not necessary that the dust should be blown out immediately. It can be taken out as desired. With respect to patent '150, you can blow out the product right away or you can let it stay a little while.

Regarding the difference in the product disclosed in '150 from the product described in '149, '149 had a certain amount of oxide, that is more black color oxide, whereas the product of the other patent could be regulated. '149 makes a product containing mostly Pb and PbO. There are two kinds of PbO, black

color PbO. In '150 according to the way you control the mill, you get more oxidized product, but you pass the same stage and you have different temperature which is a very essential thing. The two patents differ. As to the comparison between patents '150 and '020, I should say you can make exactly the same product or different products. You can make the same product or a different product. I am talking about the final product. I am talking about the product that I referred to this morning as lead suboxide, with respect to all of the patents. In all of these processes you have got to pass through this suboxide stage. So therefore you get different products depending upon the way you control the machine. According to what is taken in the drum, you will get exactly the same product in '149 and '150. According to the blast of air, you can keep it or you can blow it out right away in patent '020.

I testified in the interference at Washington. I recall being asked on question 42 of my examination in interference No. 54,798 the question: "Does any powder accumulate in the Shimadzu Machine?" and that I answered "No". In that case only five or six counts, claims, about lead suboxide were cited. In order to make suboxide of lead the material has to be blown out immediately under lower temperature. Even when you make things at a higher temperature, you have always got to pass through this stage of oxidation. Whatever oxide you get, it starts with Pb_2O and then goes on to the higher or further oxides. Pb_2O is the most interesting. "Now our experts will testify this, see. I don't know much about the chemical side of the thing".

As I understand this patent, the drawing of Plaintiffs' Exhibits 13, 14 and 15 is a proper representation. That is as I understand the patent and

the drawing. This drawing, drawn by an ordinary engineer, deals with the specifications and not with the actual machines. I know the actual machines, also I can read specifications, and the way I see this drawing it is a proper representation of what is described in the specification.

I came to America in 1926 some time in the early part of June. Patents '149 and '150 had just issued. Those patents had issued on May 11, 1926. I knew this patent was going to be issued because I was here in 1925, and concerned with the Patent Examiner and the Patent Office. I was here at the end of the year. In June 1925, I went to Germany and according to Mr. Shimadzu's instructions came back again in June 1926. I don't know exactly the date in June 1926 I arrived. It was the early part. I first saw the president of this defendant, The Electric Storage Battery Company, June 29, 1926. I was down to meet Mr. Lloyd. Apart from what was disclosed by those patents, I gave the officers of Electric Storage Battery Company, for one thing, information as to the production rate per unit of hour or unit of weight. From an economical standpoint that was very important. Of course, the manufacturing cost per pound of product is a very important thing as compared with what was bought during these days from other outside companies. That naturally interested your people I think. Otherwise, you would never start. Our patents in suit disclosed exactly how to do this. The patents didn't disclose the amount of air or temperature and how much you get per hour. Apparently your people did not know the exact numbers of the patent and specifications until the time I met your people. The patents had issued. But there was a question as to whether your people, your

company officers, noticed that such things existed. So that all my testimony about the conferences in Philadelphia and New York means that I brought these patents to the attention of the Electric Storage Battery Company. At the conference with Mr. Lloyd, Mr. Hall and Mr. Stoughton in Philadelphia and New York, of course, I cited all the patents that we had obtained in this country. I made a copy of the Japanese application and patent numbers for Mr. Lloyd's reference. I also had a very important Japanese patent translated into English and gave a copy to your company for reference. There were about ten of them, most important Japanese patents, of which I gave you a translation at that time. All of these Japanese patents had issued. They did not exactly correspond to the American patents. They differed in many, many parts, as for example, the Japanese patents had no perforation while the American patent had perforations, things like that. It was a question of whether the walls of the rotating mill were perforated or not, or put the air through or not. Because of such differences the patents did not exactly correspond to each other. There were such minor differences as are disclosed in the specifications of the patent in suit, namely, that you could use the rotating drum that is perforated, or you could use one that was not perforated, without the air or with the air. "Without air" means without any equipment to supply air artificially.

The witness here referred to Plaintiffs' Exhibit 9. We weren't using any fan or anything else to send air in. I did not show the drawing of Plaintiffs' Exhibit 9 to Mr. Lloyd.

We began to get a product with our process at a temperature somewhere below about two hundred degrees Centigrade. That is three hundred and ninety-

two degrees F. The product is different at three hundred and ninety-two degrees F. as compared with the room temperature, because oxidation takes place in a different way and at a different temperature. Of course you don't get the same product at three hundred and ninety-two degrees F. that you would at room temperature. It will give you a change in product. You would get some kind of product at one hundred degrees Centigrade, which would be two hundred and twelve degrees F. Other conditions remaining the same, when you operate at one hundred and twelve degrees F. you get a different product from that which you would get operating at two hundred and twelve degrees F. At one hundred and twelve degrees F. the product would not be very different from that at one hundred and twenty-five degrees F., as the temperature range is so close. There will be some little difference in the product between one hundred and twenty-five degrees F. and one hundred and fifty degrees F. I don't know exactly how much. The difference would be a difference in oxidation. There would be a slight change in the difference between one hundred and twenty-five degrees F. and one hundred and fifty degrees F. and that which you would get between one hundred and fifty degrees F. and one hundred and seventy-five degrees F. As the temperature rises, products change accordingly. If you operate at room temperature your product would contain mostly metallic lead.

I didn't hear Mr. Stoughton say when I was in New York at Clerk and Marks that our patents were invalid by reason of our Japanese patents. He never said a thing at all. The only thing he said was "We will have to look over again". Then give me an answer. I went down there many times for the purpose of endeavoring to get the Electric Storage Battery

Company to take a license under our patents. That was the mutual interest. Your people were so interested in this process. Therefore, we might be able to let you have prices or patent right. They never sent for me, but Mr. Cary told me that his people were very much interested. Mr. Cary told me that when I met him the 29th of June 1928 in his office in Philadelphia I had gone to see him in Philadelphia. That same day Mr. Cary took me to the head office of the Exide Company. The defendant never sent for me exactly.

I spoke of the German patent application. It was opposed by the Tudor Company, but the Tudor Company didn't use its own name. A witness represented the Tudor Company. I got the name of the engineers representing the Tudor Company. The Tudor Company is not one of our licensees. It never has been. No license was ever granted by Mr. Shimadzu, the owner of these patents, to any of the people who were opposing him in Germany to my knowledge.

Re-direct-examination.

By Mr. Whitcomb:

In connection with all experiments with CO_2 gas, of course, some heat of friction was developed, but such an amount of CO_2 gas passing through naturally cools down, and the friction of the materials on each other would not give you much friction heat. The room temperature was seven degrees Centigrade and the whole mill wouldn't go up to more than thirty-one or thirty-two degrees Centigrade. When you have air you have oxygen, and you have little friction, the air starts oxidation, oxidation heat, which according to my memory is just equivalent to what

the power supplies to the machine. A tremendous amount of oxidation heat is going on.

Q. Then the use of the air contrasted with the use of the drum without air is a decided difference in your opinion, is that right?

A. Therefore there is a difference between them.

When I was talking about the difference between the United States patents and the Japanese patents, I considered that a major difference, of course. It is a major difference when a Japanese patent failed to show the use of the air. When I was testifying about the use of different temperatures with respect to the use of the apparatus of the '150 patent, I was referring to the different amounts of the mixtures of the materials, metallic lead, Pb, Pb_2O and PbO. What I mean is the proportion of these three change. I do not mean any substantial differences other than proportions. The information I was trying to give to Exide above what was shown in the patent concerned the manufacturing cost per unit weight, which is very important. I think I gave them specific figures as to how much it would cost per hundred pounds of oxide by Shimadzu process.

Re-cross-examination.

By Mr. Morris:

With respect to my last answer that it was only a change in proportions and not a change in the character of the product of the operation, I think the proportion of the mixture changes but not the character. I did say, page 19 of our interference, with Mr. Hall, No. 54,798, in answer to question 92, referring to Mr. Hall's process, which consisted in part of the use of a Hardinge Mill and feeding the balls

in one end of the Mill and the dust passing out at the other with air passing through the Mill in one hollow trunnion and out the other—

"In this process no matter how much air is supplied through the mill, it will not give a motion of carrying the forming powder and its medium. In such operation powder forming in the mill filling up the space between the balls, remains longer until it is mechanically discharged or spit out from the end of the mill. Therefore at such a high temperature as 300 degrees Fahrenheit will convert the producing powder into a higher state of oxide. This is the practical reason why Hall's product shows a yellowish olive green color."

Q. Did you say at page 18, in answer to question 89:

"The principal difference between the two is that in the Shimadzu process we take the powder as quickly as possible as it formed, whereas in Hall's mill the powder once formed stays for a very long period under excessive heat generated in that mill; that is, the operating temperature is too high to produce suboxide. Whereas the Shimadzu mill separates the forming powder very quickly and collects it at the place under a comparatively lower temperature so that the powder has no chance to transform into a higher state of oxide."

And then the next question, which was 90, this:

"Would that apply to all of the Shimadzu Mills—different forms of them?"

And was your answer to that:

"Yes."

Have I quoted you correctly?

THE WITNESS: What you read is correct, as I remember. I have nothing to say yet about this explanation. If you ask me why I said so there is reasons, of course. That interference case involved only four or five claims, mostly about suboxide, how to make lower state of oxidized product. In that application, if your temperature is too high, and you keep the material in the drum so high, you can't get the major portion of suboxide, or so-called lower stage of oxide. In order to do that you must remove the powder quickly as formed and the temperature should be a good deal lower. That is why the difference. The processes are different. Coming to the general operation of the mill, you could produce both processes exactly the same. What is taken in the drum is exactly the same thing, and you will get the same proportion of the product. Even if you operate at high temperature like Mr. Hall's machine, you will have exactly the same kind of oxide present in there. While at lower temperature the proportion changes but you have always three kinds of oxides, I mean materials there.

Q. At page 15, question 64 was this:

"Why was the powder in the Hall mill yellowish olive green, while that from the Shimadzu mill was black oxide?"

and was your answer not this:

"Because Hall's product must be higher oxide—higher than suboxide. I will state it this way: Because Hall's product is in the state of oxide,

whereas the product from the Shimadzu process is mainly composed of suboxide."

Is that right, have I quoted you correctly?

This description is right, but it referred to just what we had in the claims in the interference case, nothing else, it didn't cover the whole patent claims.

We tried a Hardinge Mill. We tried to operate the Hardinge Mill at Depew just duplicate strictly according to Mr. Hall's specifications. We tried for ninety-four hours continuously and found all about it. I was there every day and I knew exactly what was going on. When the Mill was operated we got exactly the same result that Mr. Hall had specified and there wasn't any amount of suboxide in the product. That was what we wanted to prove in the interference case. We couldn't prove it. We wanted to get some suboxide so Mr. Hall could claim the interference case. He apparently thought he could make the same product as Shimadzu according to his specifications. That is why he found himself in an interference case. We wished to see how Hall's machine operated under his specifications and we got exactly the same thing Mr. Hall said in his specifications.

Q. And was the question page 129, number 36 as follows:

"Now can you explain in your own way why you can not get lead suboxide with the Hall apparatus, and do get it with the Shimadzu apparatus?"

and was your answer this:

"In Hall's apparatus he charges so much lead balls in the drum, and the drum itself revolving at comparatively very slow speed, and a very

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small quantity of air passing through the mill, and the mill itself kept at such a high temperature as 300 degrees Fahrenheit, and the way operated the powder produced in the drum stays a very long time in the mill; therefore the finely divided powder will change into higher oxide. Suboxide of lead can not be produced at such a high temperature and under such a condition as described above. That is, the powder that was formed stayed in the drum a very long time and evidently was transformed into high oxide. That is why the product of Hall's process shows a yellowish olive gray color, quite different entirely from suboxide of lead. Furthermore, not only the quantity of air passing through the mill, the way of feeding the air into the mill, not used as a medium of carrying the producing powder. It is only partly utilized as an oxidizing agent. That is the reason why the powder stays so long in the drum under such a high temperature— it is practically impossible to produce such a highly reactive powder as lead suboxide under such a high temperature."

Have I quoted you correctly?
A. Yes, according to the temperature.

Re-direct-examination.

By Mr. Whitcomb:

I mean by "according to the temperature" that Hall's machine is operating at a higher temperature, produces a higher grade of oxide product. For that reason he can't get the suboxide stage of product as a final product. I have seen Dr. Wilson's report on the inspection of Exide's plant for this case. Hall's

patent disclosure did not disclose the same thing. He grinds metallic lead into fine powder first, then oxidizes under controlled temperature. I think that is what that means. Mr. Hall employed a grinding mill like the Hardinge type. I know almost exactly how the Exide machine at present operates. It is quite different from the process which we tested in Depew, following Hall's specification.

Re-cross-examination.

By Mr. Morris:

I don't mean that the mill operated by Electric Storage Battery is different from the operation disclosed in the Hall patent in the way described in the patent. But the machine itself, taking the Shimadzu and Hall's, is exactly the same. Everything takes place exactly the same. There isn't any difference except in the shape of the drum and things that don't count. You can take the temperature, air, amount charged, anything, you can change according to your desire. From my experience of fifteen years, the construction of the machine, the way it operates, is exactly the same. Mr. Hall operates at a temperature of about three hundred and forty degrees F. In his testimony in the interference case he said three hundred, so we tested at three hundred. His product is perhaps a little different from the yellow oxide. At three hundred and thirty, three hundred and forty degrees F. there is a little difference, of course, Because of the temperature differences. I should think that the product that Electric Storage Battery is making now is a little different from the product that Hall was making at the time of the interference. There is a higher degree of oxidation now, when it is operated at three hundred and forty or three hun-

dred and forty-five degrees F. There is a greater proportion of oxidized lead. It may contain a small amount of suboxide and metallic lead besides. His product, the yellow, or olive green, might have contained some of what you call suboxide. It may have contained that when I was in the interference with him. I wasn't sure at that time. I think the oxidation would be higher at three hundred and forty or three hundred and forty-five degrees than at three hundred degrees F. The product that we got at Depew in connection with the operation during the interference with Hall may have contained a small portion of lead suboxide. It may still have some proportion. But less now with the three hundred and forty to three hundred and forty-five temperature than he would have operating at three hundred.

Re-direct-examination.

By Mr. Whitcomb:

No X-ray examinations were made in 1919. I have seen some of the recent examinations. We do not have the same method of tests now that we had in 1919. Now you have the X-ray method. I am sure that there was a small portion of lead suboxide and metallic lead in the mill during the interference. I think Hall's apparatus also had a lot of suboxide during the interference. I think they had ninety per cent of suboxide in the mill in Hall's plant as made during the interference for some few seconds. But he had it, at least.

Re-cross-examination.

By Mr. Morris:

I was talking at that time about your product.

Now I am talking of what is taking place inside the mill, a different thing entirely. I was dealing then with what you got outside the mill. I am dealing now with what he gets inside the mill, before the final product goes out. My theory then was that Hall could not made "suboxide", according to his specifications. That was in the interference case. It was my opinion then that he had suboxide, as I designated, inside the mill. At the time of the interference in 1930, we made some tests and tried to follow Hall's specifiactions. We didn't get any lead suboxide as a final product. According to his specifications you wouldn't get lead suboxide. As I understand it the lead never directly oxidized into litharge from metallic lead. Metallic lead never oxidized directly into higher oxide. I didn't have any idea as to whether the final product he got out of the mill had lead suboxide in it. I did think that whatever he got went through the stage when there was lead suboxide in it.

Counsel for plaintiffs here offered in evidence the Report of Inspection of the Gray Oxide Plant of The Electric Storage Battery Company, consisting of the report, the supplemental report and the drawing attached thereto, made by the Court's expert, Dr. Wilson, which was received in evidence and marked "Plaintiffs' Exhibit 20".

Re-cross-examination.

By Mr. Morris:

Q. In the Interference proceedings in Washington, number 54,798, I read from the printed copy of the record, question 79, at page 135, or page 17 of your testimony, this question:

"Q. Did the mill have holes in it?

"A. We have two kinds of mills: one having holes on the surface of the cylinder, and others only provided with the bent pipes in the mill so that air can blow through the pipes on the surface of the contents. The principle of these two types is exactly the same. The main point is to blow out the forming powder as quickly as possible so as to let escape the powder as it formed."

You so testified?

A. Yes.

Q. Turning to page 147, question 112:

"Q. How about the powder that you got from the reproduction of the Hall machine—how did you find out that was not lead suboxide?

"A. The first, its color, and when I observed through a miscroscope it contained a large amount of colored oxide, and it did not spontaneously oxidize even when a lighter match was applied to it. In comparing with Shimadzu's product I think it does not contain any quantity of suboxide. That is, the operation, the process is entirely unfit to produce such a highly reactive powder as suboxide. I think the result of our chemical analysis of the product we obtain in the Depew experiment will show more closely the result of above."

You so testified?

A. Yes.

Q. Page 512 in the other Interference, namely, number 56,224, page 54 of the last Interference, of your testimony,—

MR. SCHAFFER: What page of the record?

MR. MORRIS: 512.

MR. SCHAFFER: Thank you.

By MR. MORRIS:

Q. RDQ281:

"Mr. Ishimura, in the Hall application 702,889, it is stated at the bottom of Page 3 and at the top of Page 4:

> 'From the foregoing description it would be apparent that the pieces or balls of metallic lead are reduced to powder by mutual attrition, and that powder is oxidized under controlled temperature, and available oxygen conditions.'

If you treat those balls by oxidizing the surface, then grinding off the oxide that you have formed on the surface and oxidizing it as stated in that passage that I have read, could you possibly produce some oxide or lead?"

"A. It seems to me that there must be something missing there: that is, the pieces of metallic lead ground into powder form, then to oxidize such powder into the higher oxide, are difficult things to do: that is, unless you oxidize first the surface of the lead, it is impossible to make metallic lead powder into the powder lead form. That is, you have to oxidize first: then, such oxide, being comparatively brittle, compared to the metallic lead, is easier to scrape off into the powder form. Therefore, the description specified in that Hall Patent Application seems to me illogical, in case of converting finely divided metallic lead powder into sub-oxide; it seems to me also difficult to catch such a transformation point from metallic lead to sub-oxide.

"DQ282. In the Shimadzu Process, is the powder oxidized after it is ground off?

"A. No, it is not. The metallic surface is first oxidized, and the forming oxide is abraded off in a successive operation."

Q. You did so testify?
A. Yes.

Re-direct-examination.

By Mr. Whitcomb:

Q. Wait a minute, Mr. Ishimura, then on page 165 of the record that appeared before the United States Court of Customs and Patent Appeals, in Washington, did you not testify:

"You are quite sure you can take a Hardinge machine and make lead suboxide, can you?
"I cannot tell you how to modify it, but I know that a great change ought to be made if you want to make a suboxide on the Hardinge type mill. But I know it is impossible to make suboxide according to the Hall specification."

A. Right.

The Hall statement is directed to the claims involved in interference, not covering all claims of the Shimadzu patent, therefore, my statement should be judged with reference only to these five or six claims involved in the interference. I mean that I was testifying in the interference as to the claims of the Hall patent, not as to whatever actual process was going on in the defendant's mill. At the time of the interference nobody representing our side had been in the defendant's mill. We did not know what the actual operation was. I was testifying with respect to a

theoretical mill built according to the Hall specification, and a test made by us with such a mill. What we did was exactly according to the Hall specifications. Some change would have to be made to make them operate like the Shimadzu process, as, for example, by increasing the amount of air, increasing or decreasing the charge, increasing the speed and also controlling the temperature in certain ways. I don't think you would have to add any apparatus to the machine or change the shape of the drum which doesn't count anyway. At the time of the interference neither I nor anybody representing our side had any of Hall's product as made by Hall. In the first interference neither of the counsel for either side asked me what went on in the transformation in the mill itself.

GEORGE L. CLARK, an expert witness called on behalf of plaintiffs, having been first duly sworn testified as follows:

Direct-examination.

By MR. WHITCOMB:

I am Dr. Clark, from the University of Illinois. I have been at the University of Illinois eight years, now beginning my ninth year. I am a graduate of Depauw University, with a degree of Bachelor of Arts; of the University of Chicago, with degrees of Master of Science and Doctor of Philosophy; professor of chemistry following the war at Vanderbilt University; three years research fellow at Harvard University in physics; three years assistant professor of applied chemical research at the Massachusetts In-

stitute of Technology; and since 1927, professor of chemistry at the University of Illinois. I have written books on chemical and technical subjects. They are "Applied Ex-Rays", which has appeared in two editions, 1926, and a second edition in 1932, published by McGraw-Hill Book Company of New York.

Q. What have you to say about the X-ray use and methods of examining materials, briefly and broadly, first?

A. The ordinary use of X-rays familiar to the layman, of course, is that in medicine, where, of course, the familiar broken bones and teeth, and so forth, may be examined by radiograph, by radiography, the science of radiography, in which we depend upon the differential absorbing power of these invisible rays.

However, since 1912 it has been definitely known and established that X-rays, being similar to ordinary light in every respect except wave length, has certain fundamental physical, optical properties, such as polarization, reflection, refraction, diffraction. It was not known until 1912 what could be used for purposes of diffracting X-rays in the ordinary optical sense, but in that year von Laue, in Germany, discovered that ordinary crystalline substances, by virtue of the fact that they are constructed from atoms and molecules in regular arrangement, on equidistant parallel planes serve admirably as three-dimensional diffraction gratings for X-rays. Consequently, we may depend upon this phenomenon of diffraction not only to measure the spectrum of X-rays, the wave lengths contained in an X-ray beam, but we may reserve the process and study the ultimate structure, the ultimate arrangement in space, the ultimate architectural plan of solid substances, particularly solid substances which we know as crystalline.

THE COURT: Yes.

Q. It might be a good idea if you would tell me what diffraction is. I don't know what it means.

A. Well, diffraction is the optical property of curling around an obstacle. For example, if you will remember from your days in physics, we rule lines very close together on glass or metal and allow a sunbeam or ordinary ray of white light to fall upon that grating. The white light is spread out into a rainbow of colors into its component spectrum, as we call it, and this grating effect, of course, has been known for many, many, many years.

Well, now, the wave length of X-rays is only about one ten-thousandth as long as ordinary white light, say yellow light, and under ordinary conditions such as grating, where we have these fine lines alternately scratched, and then, of course, transparent, those lines could not be mechanically ruled closely enough together so that under ordinary conditions we could produce diffraction of X-rays by such a grating. We know now how to do it, but in the days of Roentgen and his contemporaries they did not know how to do that, so from 1895 to 1912 there were no lines closely enough together, or planes known, until, as I said, suddenly this German physicist discovered that we are simply surrounded on all sides by perfect diffraction gratings, simply because in a crystal, which has its perfectly defined parallel faces, which indicates, of course, a very definite internal arrangement, also, we have the atoms and the molecules, the ultimate atoms and molecules lined up on planes which have a spacing between them, the same order of magnitude as the wave length of the X-ray beam, namely, say one Angstrom unit, or ten to the minus eighth power centimeters, one one hundred

thousandth of a cent meter, so because we have those compatible dimensions a crystal then serves to break up the X-ray beam, or these X-ray beams, so to speak, curls around this equidistant parallel arrangement.

Of course, the phenomenon is actually more complex, because secondary X-rays are generated, and those interfere in accordance with perfectly definite optical laws, and go off in perfectly definite directions.

Q. Well, all right, go ahead.

A. Now, this, utilizing, then, this phenomenon of diffraction, it is at once evident that we are dealing with an examination far beyond the powers of a microscope, as regards the actual identity of the crystalline structure of any particular substance, and if we use X-rays, whose wave lengths are known, and produce such a diffraction pattern on a photographic film or plate by these definite laws of optics we may interpret that pattern produced by the bending of these rays by a particular architectural plan in terms of exactly what that plant is, in this ultimate sense. Consequently, we may use this method to identify given substances and to differentiate between different kinds of chemical substances, by virtue of the fact that each pure chemical compound has its own perfectly definite architectural plan.

By Mr. Whitcomb:

Q. Have you recently made some examinations of some samples delivered to you from Dr. Wilson?

A. We have.

Q. Well, will you go ahead and outline the technique you employed in connection particularly with this X-ray examination, first.

A. In beginning this examination some time ago we utilized the methods, the so-called diffraction meth-

ods then available, and, of course, incidentally discovered that these products which are of interest to all of us here instead of being amorphous were distinctly crystalline, though very, very finely powdered, yet did this produce a distinct, definite crystalline pattern, and it was perfectly well indicated also we were dealing with mixtures.

Now, in the first work, the first technique which we utilized, we found not a very satisfactory result, because of the very long time required for producing these patterns. Of course, lead is a heavily absorbing substance. The technique at that time, three, four or five years ago, consisted in placing a powder in a fine glass capillary, or in some other suitable container, and with the apparatus then available adjusting that in a beam of X-rays from a molybdenum target X-ray tube. These exposures required many hours, sometimes as many as forty-eight or sixty hours or more. The films which were produced were not very satisfactory, and by virtue of this long time exposure were fogged, obscuring quite definitely any faint lines which might be due to the presence of any materials present in small amount.

We began then a development or a study of technique with the following things in mind, first, very materially cut down the time of exposure, down to a very minimum, so that in the course of exposure we would not be subject to the possibility that the sample was changing during that long time; secondly, to produce—

Q. Now, pardon me,—

A. Yes.

Q. —how did you do that? What did you actually do for that number one?

A. We utilized then the most powerful X-ray tubes available upon the market, that run at very

much higher currents, with very much higher intensity of X-ray beam, installing the so-called Philips Metallix tubes, made in Holland. These were copper target tubes with very thin Lindemann glass windows. Instantly, by running these at their maximum capacity, we found that we could make exposures in one hour or less, as compared with two or three days, or very, very many hours by previous trials with our previous apparatus.

Q. What about the sample itself?

A. The sample, we did not, of course, want to enclose, if possible, anything nor introduce any extraneous effects of any kind—

By The Court:

Q. Now, when were those examinations made? Were you talking about three or four years ago,—

A. Well, I am just—

Q. —or are you talking about now?

A. Well, I am coming to the technique which we have used in all these later examinations.

Q. Well, I say, but when you started to develop this technique—

A. Yes.

Q. —it wasn't on samples of lead, was it?

A. Well, no, no.

Q. Well, that is what I mean.

A. It had to do with all of our general researches.

Q. Sure, I understand it.

A. Yes.

Q. That is what I want to get clear. Go ahead.

A. We wanted to avoid the necessity of using any containers, but at the same time making it perfectly definitely sure that the sample was not changing during any exposure. This was accomplished by the de-

sign which is generally familiar to X-ray people, a cylindrical camera which could be—in which the exposures could be made in vacuo, or in any inert gas in which the sample could be kept at low temperatures or controlled in any way necessary.

The sample was prepared as a wedge shaped sample in this inert atmosphere or in vacuum, so that the X-ray beam, this powerful X-ray beam, would pass across the edge of the wedge-shaped sample and register on the photographic film.

With these experiments then it was found that a sample, an exposure could be made very, very much more quickly, that the X-ray film produced had a very clear background for the purposes of microphotometry, and that under these conditions samples in which we are specially interested here could be studied in very short times of exposure, without change.

By Mr. Whitcomb:

Q. What about the wave length?

A. We utilized, as I say, copper target tubes, not only for the purpose of producing a powerful beam, but also for the purpose of gaining a greater resolution, a greater distance between lines. We have with molybdenum radiation, which is very commonly used, a predominating wave length of .71 of an Angstrom unit. With copper we have a predominating wave length of 1.54 Angstrom units. Then we have nearly, in a sense practically double the dispersion and resolution of the path, so that lines very, very close together could be spread apart and more easily analyzed.

Q. Then, as I understand it, from your method you have permitted your pictures to spread the lines

out more, so that you could pick them out more easily?

A. Yes.

Q. What about the materials tested themselves, did you use all one material or did you separate any parts thereof? If so, please explain that.

A. In the course of the examination of these lead oxide materials we have made at least five hundred separate diffraction films.

By The Court:

Q. Now, when you say "these lead oxide" do you mean the samples that Dr. Wilson submitted, or do you mean all the lead oxide—

A. All the lead oxides we have studied.

Q. All right.

A. The samples submitted by Dr. Wilson, samples from the Prest-O-Lite Storage Battery Corporation,—

Q. I see.

A. —samples which we prepared ourselves, and so on.

Q. All right.

A. Including one hundred and twenty-five separate experiments on the decomposition of lead oxalate.

By Mr. Whitcomb:

Q. While you are on that you might explain briefly what was the object in that.

A. It has been known for a great many years, or even from the time of Berzelius, that lead oxalate, a pure chemical compound, when heated in a vacuum, dissociated or decomposed into an entirely new substance, under ordinary conditions a velvety black substance, to which these chemists, Berzelius included,

and subsequent men, assigned the name lead suboxide.

We find in the literature many references to this reaction. Of course, there has been disagreement by various authorities in the literature, the chemical literature, as to just what is produced by the dissociation of lead oxalate. It has seemed very advisable, therefore, to study the process, this chemical reaction, very thoroughly, not only for the purpose of seeing whether such a thing as lead suboxide did exist, but to study a molecule, to study this reaction in the sense of a molecular dissociation, where a molecule, a single chemical molecule breaks down into other species of molecules, and, of course, it follows that depending upon the conditions of temperature and time and gaseous atmosphere, equilibrium, and so forth, that widely different products might be expected from the dissociation of lead oxalate. These experiments were undertaken, therefore, as simply a fundamental series of experiments of molecular dissociation in the attempt to prepare, if such a thing did exist, lead suboxide in as pure form as possible, and consequent y these, about one hundred and twenty-five experiments—

By The Court:

Q. What is lead oxalate?

A. Lead oxalate has the formula PbC_2O_4. Oxalate is—oxalic ac d is a well-known organic acid, and it is a salt formed between lead and oxa ic acid.

By Mr. Whitcomb:

Q. Did you succeed in discovering the suboxide?

A. As we proceeded with these experiments it became immediately apparent upon first examination of the films that there were the well-known diffraction

lines for metallic lead, well-known diffraction lines for red tetragonal, lead monoxide,—

Q. PbO?

A. PbO, and under some—

By The Court:

Q. Is that what they call litharge?

A. Yes.

Q. PbO?

A. PbO, litharge. Your Honor, we might make it clear that there are two kinds of PbO, two crystalline forms of PbO. One crystallizes in the tetragonal system, so-called red, although the color means little or nothing, stable at lower temperatures, and another compound. PbO, same chemical composition, which crystallizes in the orthorhombic system, which is stable at high temperatures, so we are speaking now of a single variety.

Q. Yes.

A. Single pure variety of one of these two forms, crystalline forms of lead monoxide, or litharge.

In addition to those lines which predominate upon the pattern—

By Mr. Whitcomb:

Q. These two?

A. These two.

Q. Metallic lead and PbO?

A. Metallic lead and PbO—there appeared additionally in some of the samples, not all of them, depending upon the temperature, additional lines, due to some additional substance, crystalline substance. These lines could not be accounted for as beta lines. By beta lines we mean lines due to another weaker component in the X-ray beam. They could not be assigned to metallic lead. They could not be assigned

to red tetragonal PbO or to orthorhombic PbO. A careful analysis of these lines, many of which were very, very close to the other lines, and some of which actually were superimposed upon other lines, indicated a new type of structure, which fit a cubic lattice, and which in general correspond—

By THE COURT:

Q. Which fit a what?
A. Cubic, cubic crystal structure.
By MR. WHITCOMB:
Q. Cubic lattice?
A. Cubic lattice, yes.

THE COURT: Lattice.

THE WITNESS: In general corresponding to results which were reported in 1926 by an Italian by the name of Ferrari.

These experiments then were continued, always producing variations, trying to produce greater quantities of this additional substance. The greatest amount which we have ever been able to produce, at 310 degrees centigrade, in vacuum, was 29—nearly thirty per cent of this additional substance, additional to metallic lead, or to red tetragonal PbO.

The conclusion, therefore, is based upon these films, prepared with the greatest care, and careful microphotometry, curves which we can demonstrate, is that this mooted substance lead suboxide, does actually exist, although it may be a very unstable, a relatively unstable, a very unstable substance.

By THE COURT:

Q. Well, now, may I ask you whether that con-

c'usion is in conflict with what Dr. Wilson says on page 7, which is, "First, lead suboxide does not exist in the pure condition. The black powder obtained first by Berzelius by heating lead oxalate in a vacuum is not pure Pb_2O."

A. If we take—

Q. Is the conclusion you have stated in conflict with that?

A. No, that is exactly right, we take the final product, as produced by lead oxalate, or by other processes, we cannot under any conditions which we have yet found, at any rate, produce Pb_2O to the exclusion of these other two components.

Q. You mean you cannot separate it from the others?

A. We cannot separate it, but I mean in the mixture, the compound, the powder which is actually produced, we have a mixture rather than a single constituent.

Q. I have an idea, it might be important, and if it is I don't understand it, I don't know what you mean by the thing existing but not existing.

MR. WHITCOMB: In the pure condition.

THE COURT: In the pure condition.

THE WITNESS: Yes.

By THE COURT:

Q. And then you say you can separate it?

A. Yes.

Q. Well, but how can you separate it, if it exists and you can separate it, why won't you get it in the pure condition?

A. Well, we can, Your Honor, produce it in practically pure condition by separating it from this mix-

ture prepared at high temperatures, and that is a new series of experiments in which we utilize a supercentrifuge.

Q. Well, that is all right,—

A. Yes.

Q. —but then that certainly is in conflict with the statement that lead suboxide does not exist in the pure condition, to my mind it is, anyhow.

A. Yes.

Q. Now, there may be something that I am missing in your way of using words, but I don't know.

A. Dr. Wilson, of course, has in mind, and if we consider his idea there that lead—that the production, the actual production of lead suboxide by one step, by some chemical process, will not produce pure lead suboxide by any known combination of things that we know now. We have to resort to a further step, taking this mixture, containing these three separate compounds, very intimately mixed up together, and then attempt by some additional physical means to pick out or take away these three apart from each other.

Q. Well, but you say you can do it?

A. We can do it, yes.

Q. Well, but, then, that certainly, to my mind, is in conflict with the statement that lead suboxide does not existing in the pure condition.

A. Yes.

Q. Because, after you do it, you get it—

A. We have it.

Q. —in pure condition.

A. Essentially pure condition.

Q. Then it does exist—

A. It does exist.

Q. —in the pure condition?

A. Yes.

Q. So that that statement is directly in conflict, as I read it, with Dr. Wilson's statement.

A. These facts, of course, were not known at the time of the writing of this report.

Q. Well, I know, but that is not what I asked.

By Mr. Whitcomb:

Q. How recently have you operated the centrifuge machine and come to those conclusions?

A. This has been within the past month, in August.

Q. Well, now, will you go back and take your samples and your films in the order that you received them, we will come to this again when you take them in the regular order, as tested by you, in the films which you made to show the proof of what you found in the various samples.

A. I would like to submit to you a series of typical films or X-ray spectra illustrating the points which I have just mentioned, fourteen—yes, fourteen different spectra, containing various pure substances, orthorhombic lead oxide, test lead, tetragonal lead oxide, oxide from Japan, Prest-O-Lite mill oxide, Exide oxide as sent to us by Dr. Wilson, various fractionated samples—another sample sent—D-4-O—sent by Dr. Wilson, a spectrum of a lead ball taken from the Exide mill, D-5-2, and the last spectrum the film for the dissociation of lead oxalate under conditions producing a maximum amount of lead suboxide.

Q. This is a base log to which you desire to refer for comparative purposes?

A. Yes.

Mr. Whitcomb: Counsel for plaintiff would like to offer in this chart with the attached note showing what each film means, and asks the clerk to mark the same Plaintiffs' Exhibit 21.

(Chart submitted by the witness Clark was marked Plaintiffs' Exhibit 21.)

By Mr. Whitcomb:

Q. Will you take them in order, one by one, so we won't get too many, without interfering with your own method of procedure, however?

A. Yes, well, I don't know—

Q. Preferably in the dates in which you received samples from Dr. Wilson.

A. Yes, samples were received from Dr. Wilson as prepared on May the 25th—

Q. What year?

A. —and June 21st, of 1934, oxides, lead oxides, original fines through a 170 mesh screen and coarse 170 mesh screen, and also lead balls from these mills. They were delivered to us July the 2nd, 1934, one lot of them, and another lot on the 23rd of August, 1934.

Films of each one of these were carefully prepared, measured, and subjected to microphotometer analysis. I have here the original microphotometer curves for those samples submitted by Dr. Wilson, together with comparative microphotometer curves for the films illustrated in this tabulation, especially the one from lead oxalate.

Q. Will you produce—

A. From these—

Q. Have you got the film for the first sample you received?

A. I have.

Q. Will you produce it?

A. These are original negatives for the entire group of samples received from Dr. Wilson.

Q. Just a moment,—

A. Certified by me on the 9th of July, 1934. Those are original negatives.

Q. Well, did you designate the first sample by a number of some kind?

A. We did.

Q. What number was the first one?

A. D-1.

Q. D-1. Have you got the film for D-1?

A. We have, there are three films for D-1.

Q. Three films?

A. One is the original oxide, one is for a fine fraction screen of 170 mesh, and D-1-C is 170 mesh coarse fraction.

By The Court:

Q. What was that, where was that taken from, and what was it?

By Mr. Whitcomb:

Q. What is that sample?

Where is it purported to be from?

A. Run 21, mill number one, time 2.10 P. M., under the screen May 25th, 1934, initialed by J. Hunt Wilson.

By The Court:

Q. Well, that was the ordinary run—

A. Yes.

Q. —of their mill?

A. Yes.

The Court: That is all I wanted to know.

Mr. Whitcomb: Shall we introduce the material, do you think?

The Court: Well, whatever you want to do, I don't know. What do you mean?

Mr. Whitcomb: Do you think it is necessary

to introduce the material itself? It is all right to introduce it. Maybe you don't want to bother with the material.

THE COURT: I won't bother with it, whatever happens, somebody else will bother with it. I don't care whether it is introduced or not.

MR. WHITCOMB: I think so, then. The thing is here.

THE COURT: All right.

MR. WHITCOMB: Counsel for plaintiff offers in evidence the first sample, marked run 21, and asks the stenographer to mark the same Plaintiffs' Exhibit number 22.

(Sample of material was marked Plaintiffs' Exhibit number 22.)

MR. WHITCOMB: Counsel for plaintiffs offers in evidence the three films relating to sample exhibit number 22 as Plaintiffs' Exhibits 23, 24 and 25.

THE COURT: I think you can probably save time by offering all these things at one time, and having them marked.

MR. WHITCOMB: Yes.

THE COURT: Reserve a string of numbers for them.—

MR. WHITCOMB: Yes, all right.

THE COURT: —because I don't think there will be any dispute as to the identification of them.

MR. WHITCOMB: No.

By Mr. Whitcomb:

Q. There are the films. Have you got photographs of these, or not?

A. We haven't got the photographs of all of them. We have simply the quantitative analysis from them and simply representative ones.

The Court: Pardon me, each one of these samples bears Dr. Wilson's or somebody's notation of what it is?

Mr. Shaffer: Dr. Wilson's.

Mr. Whitcomb: Yes.

The Court: Now, I suggest that it be agreed that they shall all be offered in evidence, with the understanding that they are what they purport to be by these labels.

Mr. Morris: May I see just a moment? I think we would have no question about it.

The Court: Yes, it would save a lot of time.

Mr. Morris: I think the same agreement would run both ways.

The Court: Oh, yes.

Mr. Whitcomb: Oh, sure.

Mr. Morris: Anything bearing Dr. Wilson's initials we won't have any objection to at any time, but for the purpose of clarity, one of my associates suggested that if the material be given one number and the films produced by the witness be given a separate number it would help to keep the record a little bit clearer.

The Court: Yes, well, sure.

MR. WHITCOMB: Sure, we will do that. Well, we will reserve that for a moment. We will introduce them all at once, after while.

By MR. WHITCOMB:

Q. Have you a chart showing the sample numbers and any charteristics that you found existent in the samples you tested?

A. As I stated, each of these films is subjected to microphotometric analysis by these curves on a highly sensitive and accurate microphotometer, which serves simply to convert lines into peaks, graphically represented as a curve on sensitized paper, from these curves.

THE COURT: What do they look like? Let me see them?

By MR. WHITCOMB:

Q. Will you show those?

A. All right.

(The witness produced the records.)

By THE COURT:

Q. That is the same as these plates, only translated into—

A. That is right.

Q. What do the high peaks mean, stronger line?

A. Strong line, yes.

Q. Yes.

A. And a low peak indicates a weak line.

By MR. WHITCOMB:

Q. And the spacing—

A. Spacing, of course, represents the identification of the lines, to what constituent it belongs.

These curves were then subjected to analysis, quantitative analysis, and this chart represents, with a constant height for metallic lead, keeping the metallic lead constant, represents the relative proportions of red tetragonal PbO and cubic lead suboxide.

THE COURT: Now, you are getting into trouble here because you are not identifying any of these exhibits. When you come back to read it over it is going to be hard.

MR. WHITCOMB: I think we ought to introduce all those exhibits now.

THE COURT: Well, let's start in now with these samples. How many of those are there?

MR. SCHAFFER: Six.

THE COURT: What?

MR. SCHAFFER: Six.

THE COURT: All right, then they will be introduced as Exhibit P-22.

MR. SCHAFFER: Plaintiff offers in evidence six tubes, six sealed glass tubes containing powder taken from Defendant's mill, furnished by Dr. Wilson, and asks that they be marked Exhibits 22, 22-A, 22-B, 22-C, 22-D, 22-E, and 22-F. Now, do you want me to identify the data?

THE COURT: No, it won't be necessary, you just mark them.

MR. SCHAFFER: All right.

(Six sealed tubes of powder from defendant's mill were marked, respectively, Plaintiffs' Exhibits 22-A, 22-B, 22-C, 22-D, 22-E and 22-F.)

MR. WHITCOMB: Now, get your set of films for each of those.

MR. SCHAFFER: Plaintiff offers in evidence the films made from Exhibit 22-A, three films, and asks that they be marked 23-A-1, A-2 and A-3.

(Films relating to Plaintiffs' Exhibit 22-A were marked Plaintiffs' Exhibits 23-A-1, 23-A-2 and 23-A-3.)

(Discussion off the record.)

THE COURT: I think when you get through with that we might recess for a few minutes.

MR. SCHAFFER: All right.

THE COURT: Take a few minutes more, we will recess until half past eleven.

(Recess, 11.15 to 11.30 o'clock A. M.)

MR. SCHAFFER: Plaintiff offers in evidence three films corresponding to sample, Exhibit 22-D, marked 23-D-1, 2 and 3.

(Films relating to Plaintiffs' Exhibit 22-D were marked Plaintiffs' Exhibits 23-D-1, 23-D-2 and 23-D-3.)

MR. SCHAFFER: Plaintiff offers in evidence three films corresponding to the sample 22-E, marked 23-E-1, 2 and 3.

(Films relating to Plaintiffs' Exhibit 22-E were marked Plaintiffs' Exhibits 23-E-1, 23-E-2 and 23-E-3.)

MR. SCHAFFER: Plaintiff offers in evidence Exhibit 24-A, microphotometer curve, corresponding to films, 23-A-1, 2 and 3.

(Microphotometer curve relating to Plaintiffs' Exhibits 23-A-1, 23-A-2 and 23-A-3 was marked Plaintiffs' Exhibit 24-A.)

MR. SCHAFFER: Plaintiff offers in evidence Exhibit 24-D, microphotometer curve corresponding to films, Exhibits 23-D-1, D-2 and D-3, and also corresponding to films Exhibits 23-E-1, 2 and 3.

(Microphotometer curve relating to Plaintiffs' Exhibits 23-D-1, 23-D-2 and 23-D-3, and 23-E-1, 23-E-2 and 23-E-3 was marked Plaintiffs' Exhibit 24-D.)

MR. SCHAFFER: Plaintiff offers as Exhibit 22-G lead ball taken from defendant's mill by Dr. Wilson and submitted to plaintiff for examination.

(Lead ball from defendant's mill was marked Plaintiffs' Exhibit 22-G.)

MR. SCHAFFER: Plaintiff offers in evidence Exhibit, 23-G-1, 2, 3 and 4, which are films of X-ray analysis of lead ball, Plaintiffs' Exhibit 22-G.

(Films relating to Plaintiffs' Exhibit 22-G were marked Plaintiffs' Exhibits 23-G-1, 23-G-2, 23-G-3 and 23-G-4.)

MR. SCHAFFER: Plaintiff offers in evidence lead ball received by Dr. Clark from Dr. Wilson on August 18, 1934, marked Exhibit 22-H.

(Lead ball was marked Plaintiffs' Exhibit 22-H.)

MR. SCHAFFER: Plaintiff offers in evidence films of X-ray analysis of lead ball, Exhibit 22-H, marked Exhibits 23-H-1, 2, and 3.)

(Films relating to Plaintiffs' Exhibit 22-H were marked Plaintiffs' Exhibits 23-H-1, 23-H-2 and 23-H-3.)

MR. SCHAFFER: Plaintiff offers in evidence Exhibit 24-G, which is the photometer curve of films Exhibit 23-G-1, 2, 3 and 4.

(Photometer curve relating to Plaintiffs' Exhibits 23-G-1, 23-G-2, 23-G-3 and 23-G-4 was marked Plaintiffs' Exhibit 24-G.)

MR. SCHAFFER: Plaintiff offers in evidence Exhibit 24-H, which is a microphotometer curve of films, Exhibit 23-H-1, 2, and 3.

(Microphotometer curve relating to Plaintiffs' Exhibit 23-H-1, 23-H-2 and 23-H-3 was marked Plaintiffs' Exhibit 24-H.)

MR. SCHAFFER: Plaintiff offers in evidence Exhibit 23-I, 1 and 2, which are X-ray films of powder received from Dr. Wilson, mill number 3, run number 31, August 3, 1934. Number 23-I-1 is the screen product; number 23-I-2 is the finished product.

(X-ray films of powder from mill number 3, run number 31, August 3, 1934 were marked Plaintiffs' Exhibits 23-I-1 and 23-I-2.)

MR. SCHAFFER: Plaintiff offers in evidence Exhibit 24-I, which is the photomicrometer curve of Exhibits 23-I, 1 and 2.

Q. Exhibit No. — ?

(Photomicrometer curve relating to Plaintiffs' Exhibits 23-I-1 and 23-I-2 was marked Plaintiffs' Exhibit 24-I.)

By Mr. Whitcomb:

Q. Then will you produce the chart you have showing graphically the results of the tests from the samples, and state what it is?

A. From the microphotometer curves, an analysis was made of the amounts, relative amounts of red tetragonal PbO, metallic lead, and lead suboxide which was given a percentage of lead suboxide on this sheet, and these results are graphically represented in this diagram in which lead is given a constant height and the relative amounts of the red tetragonal PbO and lead suboxide are shown corresponding to the samples, and so on we have shown by comparison. At the bottom are shown three samples produced from the decomposition of lead oxalate C83, C113, C119.

Mr. Whitcomb: Counsel for the plaintiffs offers in evidence the typewritten sheet produced by the witness, and asks the Clerk to mark the same Plaintiffs' Exhibit No. 25, and the blueprint diagram which is produced, and ask the Clerk to mark this Plaintiffs' Exhibit No. 26.

By Mr. Whitcomb:

Q. Will you now please take one of your films and your microphotometer charts and show the court, on, say, the very first sample you tested that was given to you from Dr. Wilson, and show where you find suboxide?

THE COURT: Now, you are going through one sample just to show me how to find it, and I will assume the procedure is the same in all the other samples?

MR. WHITCOMB: Yes.

THE COURT: All right, go ahead.

By MR. WHITCOMB:

Q. Which exhibit are you looking at?

A. Let's see; maybe we better have the one that is already designated. We can produce in evidence a little later a chart which Dr. Wilson has in his possession on a large scale with colored inks, the drawings which show these various lines corresponding to each one, No. 3 in this—

Q. Exhibit No.?

A. Exhibit No. 21 is a crystal spectrum for essentially pure orthorhombic lead oxide. No. 2 is test lead, pure lead, each line, each spectrum resulting in a pure constituent. No. 3 is red tetragonal lead oxide.

By MR. SCHAFFER:

Q. PbO?

A. PbO. Now, these reproductions, of course, are not to compare with the original negatives particularly because these lines are faint, but in order to see what I want to have you see we will look at spectra Nos. 9, 10, and 11, the principal lines of which correspond to lead suboxide. These spectra were produced by the use of super-centrifuge upon the above samples prepared from the mill.

Super-centerfuge belongs to the geological survey of the State of Illinois. There were several reasons for doing this, of course, one being to try to fractionate the three materials into individual fractions. It

was impossible to predict ahead of time what we would get.

But several series of experiments were run, one of the first being to suspend the material, divide the material in a very pure, light oil, subjecting it to super-centrifuge fifty thousand r. p. m. Taking, then, the non-settling fraction of fifty thousand r. p. m., and at low temperatures carefully removing the oil, and from this fraction, that is, the finest fraction non-settling at fifty thousand r. p. m., making the X-Ray spectrum.

We had no way of knowing ahead of time whether that would be lead, lead oxide, or lead suboxide, but the spectra 9, 10 and 11 present the purest spectrum of lead sub-oxide that undoubtedly has ever been obtained.

By Mr. Whitcomb:

Q. You mean that all on lines?

A. Not all of them. There are a few faint lines corresponding to an additional substance, probably a minute amount of carbonate, or something of that sort, whole spectrum, this one right here over the so-called two hundred and sixty line.

Q. These red spots down here don't identify anything?

A. Those are ink spots. Then, of course, if you take this two hundred and sixty line up through the other materials I think you can see evidence, even in this rather poor reproduction here. Some of the other lines, of course, are superimposed directly on top of some of these other lines; you have to separate those out. But the composite of lines gives us a structure which is consistent with a cubic structure with a lattice fraction of 5.38, if I remember rightly, Augstrom units.

In all of these materials fractioned, namely, Exide prepared at the Shimadzu mill, and the Prest-O-Lite, and in the Exide process, and in the Exide mill it has been possible to concentrate in the finest non-settling fraction of high proportion of sub-oxide of lead.

This substance is - ample, of course, a very small amount he subjected to temperature in the absence of air disassociated, became black. In the presence of air it oxidized instantly, changed in color to yellow and formed letharge PbO.

Q. Please explain more in detail the use of this supercentrifuge. Is that like a cream separator, or something in a common way, so that we will understand it?

A. Yes, it is. The super-centrifuge is simply a means of modern chemical physical method of factionating extremely finely divided substance in a colloidal range, and it is called a super-centrifuge not only because of its careful construction, but also because of its high speed. Of course, the factionation takes place by view of the centrifugal force. In the liquid phase it is not separated at fifty thousand r. p. m. I think it is very interesting that this finest fraction does consist essentially of this phase, which is present in small amount in the original oxide. It is not lead and not lead monoxide.

By The Court:

Q. What did you put in this super-centrifuge before you tried to fractionate the stuff?

A. For example, take the original mill oxide.

By Mr. Whitcomb:

Q. From Dr. Wilson?

A. Yes.

By The Court:

Q. That is all No. 9?

A. Yes.

Q. The same as 10 and 11?

A. Yes.

Q. They were all fractions of the original mill oxide?

A. That is right?.

By Mr. Whitcomb:

Q. Will you please point out some of these microphotometer curves?

A. For example, an examination of D1F, which is according to our nomenclature Exhibit No. 24A shows a well defined peak which is labeled 2.63.

Q. What is that peak?

A. This is an automatic microphotometer. You can see that is on silver bromide paper. In most of these cases, of course, we can use any lines, but the 2.63 line is an unusually good one because it stands out well resolved from the other lines.

Q. You may mark an "X", and mark it Pb_2O on that exhibit?

A. Yes. (The witness complies.)

Q. Now, have you made any other type of examination of any of these samples?

A. You refer to the experiments of lead ball, the X-Ray experiments of lead ball, do you not?

Q. I understood you have films there showing that?

A. Yes.

Q. Show the Court. What you have on these films you have spoken about applies equally well to all these other films you have produced, is that correct?

A. Yes. I might say these experiments with the lead ball taken from the mill was made in successive layers from the very outside clear down into the solid metal so that any layer effect of any kind would be brought out.

Q. Did you find the sub-oxide present in those samples?

A. Suboxide was present as a protective layer under the outside layer. This tabulation on the typewritten sheet will show the concentration of lead suboxides runs up to twelve and fourteen per cent., three or four times as much in an underlying protected layer on the lead ball as in the oxide that is in the outer layer, or in the yellow Exide.

Q. As to amounts or quantities, did you find more evidence of the sub-oxide in the samples in the mill or in the product taken out of the mill?

A. The highest concentrations we have found in the mill product was found in the layer under the surface on the lead balls taken from the mill as shown by the typewritten sheet attached to the exhibit.

Q. Now, have you made any other methods of examining these samples?

A. We have.

Q. What methods?

A. Microscopic examinations.

Q. Have you got any results from that?

A. We have.

Q. What are they?

A. This exhibit No. —

A. I will introduce it. What is this exhibit?

A. This exhibit are photomicrographs made of powder as follows: a sample from the Shimadzu mill and the Prest-O-Lite Storage Battery Corporation, a sample of oxide from the Exide lead as submitted

by Dr. Wilson, a sample of oxide prepared in Japan by the Shimadzu process, a sample of powder prepared by the decomposition of lead oxalate, and a sample of Exide material which had been fractionated in super-centrifuge.

Q. You have got written on the side the names for each sample that you just mentioned?

A. Yes.

MR. WHITCOMB: Counsel for plaintiffs offers in evidence the record produced by the witness and asks the Clerk mark the same Plaintiffs' Exhibit No. 27.

By THE COURT:

Q. What does this show?

A. This powder, of course, is very opaque, and the microscopic examination is quite difficult because light will not readily be transmitted through it. Reflected light can be used, however. But in a very careful examination it was discovered in this mixture besides the very opaque dark masses which were very intimate combinations of lead and lead oxide, you could tell by the colorless metallic lead particles and particles of Exide scattered through that little clump of an additional third substance, strangely enough, considerably more transparent in very thin layers. if you will examine in the first row of Pl. 2, right in the middle of the right-hand one you will see a little clump of crystals.

Q. The next row is the big one?

A. That is right.

Q. That, you say, is Pb_2O?

A. That is Pb_2O. That is common to all of these substances. We were able to measure the fractive index, which is different completely from the other

materials. In polarized light these crystals are completely distinguished, that is, after we rotate the scope of the microscope, the crystal doesn't come in and disappear as it would with anything but a cubic crystal. It is an isotropic substance in polarized light.

Now, another thing about E12 on the right-hand side, one of these microscopic slides could be taken and carefully heated on an electric plate very quickly, and you will observe on the left-hand pattern, or on the left-hand side the beginning darkening, so that the rhombohedron crystal is beginning to change in its properties, becoming opaque, and it is very interesting to follow that process.

By The Court:

Q. How much is this magnified?

A. Six hundred times.

Q. That piece would be visible to the naked eye, wouldn't it?

A. Well, if you had it just in the right place, probably it would. Six hundred magnification is, of course, pretty good magnification. We then made the micro-manipulator needles to try to separate these little crystals from the adhering opaque powder. We found these masses very brittle, easily broken apart, and it is simply impossible to bring them altogether in a single pile because of the ease with which they broke up. These are not single crystals, but are aggregates, very thin scale with these particular properties. Down in the factionated sample—

By Mr. Whitcomb:

Q. What one is that marked?

A. 94D-12; that is just our own mark. That is fractionated Exide corresponding to the second one

from the top. We find in the fraction of this sample just a complete fill of this relatively transparent material. Some of it is very, very small, just little tiny droplets. You can see some not quite in focus there on the left-hand side. These observations were independently confirmed by the professor of optical mineralology in the department of geology.

Q. What is his name?

A. W. V. Howard.

Q. He signed these sheets?

A. He signed these sheets, yes. There is, thus, no question but that an additional substance is present even in microscopic examination, although, of course, in small amount.

By The Court:

Q. But these pictures tell you what it is?

A. No.

Q. That you have got to get from your X-Ray?

A. Yes, and identification by refractive index.

Q. The only thing the X-Ray photographs tell you is something is there that isn't either lead or lead oxide?

A. Yes.

Q. That really don't tell you any more than that?

A. It tells you that it has a cubical crystalline structure which corresponds, that is, a third different substance corresponds fairly well with the first X-Ray analysis ever made.

Q. Let me ask you about the ordinary minute analysis. Take one of those tubes; if I gave you one to analyze, to tell me what it was, you probably would know by looking at it and by feeling it from the weight of it pretty well, wouldn't you?

A. You mean supposing you didn't know that it was lead?

Q. Didn't know what it was; suppose I gave you this tube and said, "Tell me what that is"; what would be your method of finding it out, or identifying it?

A. As a chemist I would, of course, subject it to qualitative analysis first to see if it were lead.

Q. How do you do that?

A. Dissolve the substance in a suitable solution and then make the specific test starting right at the beginning.

Q. To see what reaction took place when you added certain other things to it?

A. That is right. You destroy, of course, the original material.

Q. You wouldn't use a microscopic examination?

A. Yes, you would. There is a growing science of chemical microscopy, and oftentimes you can, especially if you use polarized light, you can identify it.

Q. You have no qualitative test for this lead suboxide?

A. There is none known so far as we know at the present time.

Q. The stuff, itself, assuming that it exists, as you say it does, is fugitive, isn't it? You can't keep it before you any length of time?

A. It is unquestionably an unstable substance.

Q. Is that only because the effect of air is more stable than a vacuum?

A. Yes, in our experiments with this fractionated phase, we were surprised by the relative stability if it is kept dry and out of air. It is especially sensitive first, to temperature even in vacuum, and second, to the dampness.

Q. Did you make these microscopic examinations in vacuum?

A. No, they were made very quickly in a dry room; powder was sprinkled on a brass plate.

By Mr. Whitcomb:

Q. Do you have any charts showing the lines of a spectrum that would be present for sub-oxide as you understand it, not taken from a picture, but built up by you?

A. I have; Dr. Wilson has that chart.

Mr. Whitcomb: If Your Honor please, at this point we would like the chart that Dr. Wilson has.

The Court: All right.

Mr. Whitcomb: I will have to get it and produce it after lunch.

The Court: That is all right. Do you want to stop now?

Mr. Whitcomb: I would like to.

The Court: All right; it is quarter after twelve, if you have to have that now.

Mr. Whitcomb: This is the proper time.

The Court: All right.

(Recess from 12.15 o'clock P. M. to 2.00 o'clock P. M.)

AFTER RECESS.

GEORGE L. CLARK, recalled.

Direct-examination (Continued).

By MR. WHITCOMB:

Q. Have you a chart showing the theoretical arrangement and construction of these lines that you have been talking about as produced by an X-Ray?

A. I have.

Q. Can you produce it?

A. I can.

THE COURT: Mark it exhibit—

MR. WHITCOMB: Plaintiff offers it in evidence as Exhibit number 28.

(Chart showing arrangement of lines produced by X-Ray was marked Plaintiffs' Exhibit number 28.)

By MR. WHITCOMB:

Q. Please go ahead, now, and explain to the Court what this is.

A. Your Honor, the crystal structures of silver oxide, Ag_2O, and Cu_2O, cuprous oxide, both are very well known, because those can be prepared easily in a pure state. The first spectrum here represents the crystalline structure of pure silver axide, Ag_2O. The second one—

By THE COURT:

Q. Why don't they call that suboxide?

A. Well, they could.

Q. I mean, it is the same symbol, isn't it?

A. Same symbol, the difference being, of course, that silver has ordinarily only one combining valence, as we call it. Of course, copper and lead both have two—

Q. All right.

A. — or more. The second is cuprous oxide, also well known.

Now, these two substances crystallize alike, so-called cuprite structure, which is cubic.

The third spectrum here gives a detailed, accurate representation of the lines which we observe for the so-called oxide, or the mill oxide, many of which we have seen this morning.

Now, presupposing that lead suboxide exists, and that it has a crystal form similar to silver oxide and cuprous oxide, both of which are well-known, and taking the spacing previously found, or practically previous spacing found by the Italian, Ferrari, we reproduce in the fourth line the spectrum of pure lead suboxide, if such did exist.

Then the fifth line is pure lead, a yellow ink.

Tetragonal lead is in the green ink.

By The Court:

Q. Do you get the fourth line by subtracting the lines you find in the fifth and sixth from the third?

A. That is right, and this one here is—this is the spectrum subtracted.

By Mr. Whitcomb:

Q. Did you get this by subtraction? This is not Ferrari's pattern?

A. No, this is by subtraction from this.

By The Court:

Q. That is, the fourth line?

A. That is the fourth line.

Q. In other words, when you say that, the fourth you get by subtraction from the third?

A. That is right.

Q. Let me ask you, why had you reproduced the silver and the copper oxide there?

A. Simply because this demonstrates that lead suboxide, or this third constituent, has a crystalline structure similar to silver oxide and cuprous oxide, both of which are well-known.

Q. Is that demonstrated by the place where the lines are found?

A. And the pattern of lines, yes, you can see the two lines. There are, of course, slight variations.

Q. Yes.

A. Two here and one here, and so on.

THE COURT: All right.

MR. MORRIS: Is there a legend on that?

THE COURT: No, it is just marked P-28.

MR. MORRIS: I wonder if it wouldn't be well to have the legend?

THE WITNESS: Yes, I would be very glad to write that on.

THE COURT: All right, write on what it is.

MR. WHITCOMB: Well, of course, the chemical formula is there.

MR. MORRIS: Oh, I didn't know that.

THE COURT: Will you let me see it, then? I mean, are you through with it now?

MR. WHITCOMB: Yes, I think we are.

By Mr. Morris:

Q. May I ask what the legend is on the one that most nearly resembles Ferrari? Is that Pb_2O?

A. Pb_2O, yes.

Q. But that is not the Ferrari pattern?

A. No, that is the pattern made by subtracting the one with yellow and green ink from the total pattern.

Q. What are these two?

(Mr. Morris indicated the fifth and sixth charts on Plaintiffs' Exhibit number 28.)

A. That is pure lead and tetragonal PbO.

By The Court:

Q. Pardon me, but what is the little rectangle here to the left? Why is that separated from the long strip?

A. That is a matter of technique in the taking of the photographs, if we arrange our film in the cylindrical camera it is possible to reproduce lines on both sides of the zero, see?

Q. Oh, all right.

A. That is made purposely to show if we do reproduce lines on both sides of zero we can determine their position accurately by measuring from one side to the other.

Q. All right. Oh, it is the same thing starting again.

A. That is it.

Q. It is the same strip starting again?

A. That is it.

Q. If it was produced to the left you would get the same thing?

A. Same thing just in reverse, that is all.

By Mr. Whitcomb:

Q. Now, amongst these films that you have produced this morning please pick out and show to the Court the one you took from the actual sample and in your opinion illustrates the suboxide on this last Exhibit number 28.

A. Well, those are, the films representing this fractionated sample are the ones which correspond most—

Q. Please find it exactly.

(Discussion off the record.)

By Mr. Whitcomb:

Q. Aren't they all here, or have been introduced?

A. No, we haven't introduced the fractionated films yet.

Q. Have you got those?

A. Yes, sir.

Q. I understand you haven't introduced them this morning, have you got them with you?

A. I have.

Q. Will you now produce them?

A. I now produce the following films, number 94B, Exide, oxide received August 24, 1934, from Dr. J. Hunt Wilson, finished product, finest fraction of non-settling phase, centrifuged out at fifty thousand r. p. m. for one and one-half minutes; sample, and so on.

Mr. Whitcomb: Counsel for Plaintiff offers in evidence a film produced by the witness, and asks the Clerk to mark same Plaintiffs' Exhibit number 28-A.

(Film taken of sample of Exide oxide number 94B was marked Plaintiffs' Exhibit number 28-A.)

THE WITNESS: This is the same thing for Prest-O-Lite oxide, made by Shimadzu.

THE COURT: May I have that just a minute, Judge Morris?

MR. MORRIS: I was wondering whether that last exhibit corresponded—

THE COURT: That is what I was going to ask, exactly.

By THE COURT:

Q. Looking back at 21, those exhibits that you are referring to now, are they reproduced—

A. Yes. Just hand me that.

MR. MORRIS: The film that he just offered in evidence, however, should correspond to one number on there, as I understand it.

THE WITNESS: Yes, number 10 on here is a reproduction of, a print of the film—

THE COURT: I see.

THE WITNESS: — which is just introduced.

THE COURT: All right.

MR. WHITCOMB: 28-A.

By MR. WHITCOMB:

Q. Then Exhibit 28-A is the film from which the photograph number 9—

A. This is number 10.

Q. Number 10 on Exhibit 22, is that correct?

A. That is right—21.

Q. That should be 21, Exhibit 21.

MR. WHITCOMB: The second film you just produced counsel for plaintiff offers in evidence

and asks the Clerk to mark same Plaintiffs' Exhibit 28-B.

(Film taken of sample of Prest-O-Lite oxide was marked Plaintiffs' Exhibit number 28-B.)

MR. MORRIS: I wonder if it would interrupt too much if we can get on one of these copies of ours the corresponding original film and whether we may have that exhibit so we can keep them parallel?

THE COURT: Yes. Who has it. The witness has to have it, too.

MR. SCHAFFER: I think I have a copy.

MR. MORRIS: That is all right, we have another one.

By MR. WHITCOMB:

Q. This is 28-B, is there one that corresponds to that?

A. That is number 9.

Q. Exhibit—

A. Number 9 corresponds to Prest-O-Lite.

Q. Number 9 of Exhibit 21 corresponds to Exhibit 28-B, that is correct?

A. This is—9, 10 and 11 represented fractionated samples. This is the third one of those three, also Prest-O-Lite.

MR. WHITCOMB: Counsel for Plaintiff offer in evidence the third film produced this afternoon by the witness, and asks the Clerk to mark the same Plaintiffs' Exhibit 28-C.

(Film made of sample of Prest-O-Lite oxides was marked Plaintiffs' Exhibit number 28-C.)

By Mr. Whitcomb:

Q. And that corresponds to what?

A. Number 7.

By Mr. Morris:

Q. Number 7, or 11?

A. 7 and 11, 7 corresponds to 11. 11 is the fractionated phase of 7.

Q. Well, which film is this for, the fractionated phase or the unfractionated phase?

A. All these films are fractionated.

Q. So that this corresponds to number 7, and not to number 11?

A. Yes.

By Mr. Whitcomb:

Q. Referring now to the patents in suit, will you please look at those charts produced, Plaintiffs' Exhibits 14, 15 and 16, and state what they show, in your opinion?

A. These charts show a rotating drum, steel drum, in which are contained lead pieces or lead balls, a hopper, which admits these pieces into the interior of the drum, which rotates, a provision for providing a current or gust or blast of air through this drum, and a suitable method for collecting a fine powder which has been removed by the air.

Q. Why do you use the word "gust" or "blast" of air?

A. Those terms are specifically used in the patents in suit.

Q. And what do they indicate to you in this art?

A. Well, they indicate to me a very positive current, moving current of air, moving with considerable rapidity under possibly a pressure difference, supplying a continuous supply of air.

Q. From that description and the other material given in the patent with respect to the size of the drum, and so forth, would you be able to have a mill constructed, in your opinion, that would operate?

A. I see no reason why it would not be possible from the disclosures to construct an apparatus which would successfully produce a product.

Q. If you had sufficient air to blow material out of the drum what would that show you as an engineer in this industry with respect to the amount of air for oxidation purposes as required by these patents in suit?

A. That would indicate, of course, that there would be—concentration of oxygen was always in excess, and that there was available plenty of gaseous oxygen for oxidation purposes.

Q. Will you please then go on where I interrupted you about what this apparatus shows?

A. Well, it simply shows on this side here a dust collector, standard design for collecting the product, which is removed from the mill by the gust or blast of air.

Q. The chart you are looking at is the one for the 150 patent, is that right?

A. Yes.

Q. Will you please now refer to the 150 patent, particularly page 2, beginning at line 39, to the semicolon, where it says: "It is easy to maintain the harmony of oxidation of the surface of the material lead, and abrasion of oxidized lead."

Will you please now explain to the Court what this signifies to you, having described broadly the apparatus and features of the patent?

A. This combination it seems to me presents one of the most interesting chemical systems that is possible to imagine, and I—I would have clearly in

mind, it seems to me, that the following things are happening, and we are concerned with the following rates of the processes and the reactions.

First of all we have, we must have absorption before anything can happen, absorption of gaseous oxygen upon the surface, metallic surface, a fact, of course, which is well-known in chemistry, so that the rate of absorption under the conditions of air, the partial pressure of oxygen, temperature of the solid surface, temperature of the air, is, of course, a definite thing, although it is a variable which is controlled by these various factors.

The second rate which we might think of is this. It is well-known, of course, that gaseous absorbed films are conditioned particularly on catalysts by—their thickness, and so on—by the rate of a blast of gas passing over the surface.

Q. Pardon me, by the way, have you got a showing of the lattice structure of these materials?

A. I have.

Q. Will you produce that? We might want to use that.

(The witness produced an exhibit.)

By Mr. Whitcomb:

Q. Now, what does this represent?

A. That represents a photograph of three models. The first on the left is the model, well-known, of metallic lead, the face centered cubic lattice, in which these balls represent atoms.

The middle model, the central model, represents the structure, cubic structure, of cuprous oxide, silver oxide and lead suboxide, a cubic structure in which the metal atoms are still upon a face centered cubic lattice.

The third one on the right-hand side is a model of the crystal structure of tetragonal lead monoxide, or litharge.

These are derived, of course, from the crystal structure analysis.

Q. Are these well recognized methods of—

A. These are standard—

Q. — picturing—

A. Standard models, well-known in all X-Ray laboratories, of representing results of crystal structure analysis.

MR. WHITCOMB: Counsel for the plaintiff offers in evidence the lattice structure pictures produced by the witness, and asks the Clerk to mark same Plaintiffs' Exhibit number 29.

(Lattice structure pictures produced by the witness Clark were marked Plaintiffs' Exhibit number 29.)

By MR. WHITCOMB:

Q. When you were speaking about the absorption a moment ago can you illustrate anything in connection with these pictures of the latticework?

A. Yes, we will come to those in just a moment. The absorption so far is a purely physical phenomenon, in which we have a layer of absorbed gas as a gaseous film on the surface of the metal. In this process we have, first of all, an absorption process, and the rate thereof, the variables introduced in the thickness of that film by blast of the current of air.

Now, the third rate with which we are concerned is the rate of chemical combination of oxygen in the absorbed gas film with the metallic lead surface, and if we may assume for the—we may assume this process, for the moment, the lead atoms, or the oxygen

atoms in the absorbed film at first are held by forces which we class as physical, but under the conditions of reaction, particularly at the elevated temperatures, a chemical reaction can take place, in which oxygen atoms will enter; they have a considerable mobility, they may enter the latticework, the crystal latticework of the solid phase, namely, metallic lead.

Now, if we will observe on this model of the so-called cupric model, cuprous oxide, or silver oxide, or the lead suboxide, as we have identified it, its spectrum corresponding to the two known ones, it is perfectly reasonable from the standpoint of crystal dynamics that the lead lattice shall maintain itself just as long as possible, metallic lead, even upon the entrance of oxygen into, between the planes and among the lead atoms, and this central model shows that very thing, namely, that the lead atoms are still—or the copper atoms, the silver atoms are still maintaining their characteristic face centered cubic lattice, but that oxygen has entered, has moved the metallic atoms, slightly, of course, that is, the distance apart is somewhat changed, the oxygens take up perfectly definite positions in the space, and in the ratio of two metal atoms to one oxygen atom, thus producing, as I say, the well-known cupric or silver oxide structure, in which there is no disruption, no discontinuity, no sharp jumping around of atoms, or anything of that sort. That seems to me to be a third process which is taking place there, a rate of reaction, the oxidation, the beginning of oxidation of metallic lead to the state where the oxygen will enter the latticework of metallic lead under the conditions thus considered.

By The Court:

Q. What is the film before the entry of the oxygen atoms?

A. Well, of course, that is—the film will be oxygen and nitrogen, that is, any—any constituents of the atmospheric air. Possibly, that is a thing, perhaps, we don't know very well, possibly the oxygen is preferentially absorbed upon the metallic surface.

Q. Now, but, now, you have got to make it a little clearer to me.

A. In the air—

Q. First you start with these lead balls.

A. Yes, in the air, of course.

Q. When you speak of these pieces, and then something happens by which there is a film formed on the surface of those lead balls, that is the film you are speaking of?

A. Yes.

Q. Now, that film consists of lead and something else?

A. Yes.

Q. Or am I right about that?

A. That is right, the very first thing that happens is a gas, the gas, molecules of oxygen are taken out of the gas and attach themselves on as an absorbed film, just as if we would—

Q. Well, then, the film you are speaking of is entirely composed of gas molecules?

A. Yes, in the first,—

Q. All right.

A. — the very first process.

Q. That is what I mean.

A. Yes.

Q. Then the second step, or the second rate you speak of is the question of how intensely you oxidize. and has to do largely with the extent of the film, doesn't it?

A. Yes.

Q. More than anything else?

A. That is right.

Q. Well, then, the third step you have come to now is the entry of oxygen atoms into something, into the lead?

A. Into the metallic lead, that is right.

Q. That is, from the film?

A. From the film.

Q. Not from the outside into the film, but from the film into the metallic lead?

A. Because those are the attached oxygen molecules.

Q. Now, if I am wrong about my idea of this just stop me and tell me so; that is your idea, now?

A. Yes.

Q. I have stated it correctly?

A. That is correct.

Q. All right.

A. So that in—in this stage of which we are now speaking, right on the surface of the lead, penetrating down into the lead, we have oxygen atoms in definite arrangement. Thus we have a new compound, new crystal form, it gives a different crystal pattern, if we examine the surface of the balls, and so forth.

Q. Well, why do you assume the existence of a film rather than direct penetration by the air?

A. You can assume the existence of a gas film—

Q. Yes.

A. — to begin with.

Q. Yes.

A. Of course, in a solid-gaseous reaction, by, I suppose, thousands of papers on the subject always indicate that before reaction can take place between a static solid surface and a gaseous phase that the gas is first absorbed more or less by physical proc-

esses, physical attractive forces, and then, of course, there is a twilight zone, a very decided twilight—

Q. You mean it is simply a heavier concentration of gas—

A. Yes.

Q. — at the surface—

A. Yes.

Q. — of the solid?

A. That is it.

Q. All right.

A. That goes over, then,—

Q. I understand.

A. — into chemical combination.

Q. Yes.

A. So, then, we have the rate of superficial oxidation of lead.

Another rate, then, after a layer of this has been formed, of course, oxygen is being continually supplied from the atmosphere, and in the gaseous film, and at the given temperature it is entirely conceivable and is a matter of fact that as more oxygen is added this lead lattice, which has tried its best to maintain itself, if no longer stable, it will no longer hold any more oxygen and there is a rearrangement into the well-known and definite crystal form of PbO, litharge, so we have then the rate of oxidation, let us say, of Pb_2O, this incipient stage of oxidation, to PbO.

By Mr. Whitcomb:

Q. Do I understand you to say that the lead itself, however, would rather maintain its first condition, is that your thought?

A. As long as it can, yes, as long as it can.

Q. When it can't do that any more then what happens?

A. Then as more oxygen is added, that is, in the ratio of one atom to one atom, or one molecular

weight to one molecular weight, this central configuration in this diagram is no longer stable, and there is formed the latticework on the right-hand side which is characteristic of litharge.

Now, another rate with which we are concerned then is the rate of diffusion of oxygen through the outside, protecting, oxidized layer into the interior of the ball or piece of lead, because that is a very decided factor, the rate of diffusion of further oxidizing air or oxygen through the protecting or saturated outer layer. That comes into the picture.

By The Court:

Q. Now, would all this happen if there wasn't any friction or abrasion of the lead surface?

A. All of that is concerned, yes.

Q. What?

A. I say all of this will take place, especially this last process.

Q. Would it take place without any abrasion, in case these balls were just stationary or static,—

A. Yes.

Q. —and you blew air on them, would this same thing occur that you are speaking of?

A. They establish an outer layer.

Q. All right.

A. That would become higher oxidized. Then the penetration, of course, would be very, very slow, because of the protecting outer layer, it would all depend on how fast chemically and physically atmospheric air can penetrate through a saturated outer layer into the unchanged metallic lead on the interior.

Q. All right.

A. Then the next rate with which we are con-

cerned is, of course, the rate of removal by abrasion of this outer, oxidized layer.

By Mr. Whitcomb:

Q. That is the mechanical action, is that right?

A. That is the mechanical action introduced by the tumbling.

Q. Upon what does that depend?

A. That depends, of course, in this process by the rubbing or abrading of lead pieces or lead balls rubbing against each other, hitting each other, and rubbing on each other.

Q. Does the speed have something to do with that, of rotation?

A. The rate of abrasion, in other words, the actual rate of abrasion in one of these many factors involved will, of course, depend upon the rate of the charge, that is, the amount of material present, the size of the individual pieces or balls, the rate at which the rotation takes place, but the process goes on, it is just merely the details as to the rate of abrasion which is determined by these variants.

Q. Well, then, in the process involved in this suit, such as disclosed in this patent, when you arrive at the third form of latticework shown on the exhibit what happens to the lead suboxide then, in your opinion?

A. We know that the exterior of any lead piece which has been exposed continuously to an excess of oxygen consists largely, very largely, of PbO, tetragonal lead oxide. In our examination of successive layers, however, of such a ball whose very outer layer was lead monoxide, we find increasing concentrations and evidences of lead suboxide. In fact, we find evidences of lead suboxide right down, in intimate contact with the apparently unchanged metallic lead,

metallic lead serving to stabilize it. Consequently it is evident that the outer completely oxidized layer, PbO, forms a protective layer, which has not yet permitted enough oxygen to penetrate, or, perhaps, the temperature conditions to be such that all of the suboxide on the interior, underneath this and in contact with the metal, shall have all been transformed into the saturated PbO.

Thus we find increasing concentration down underneath.

Q. Now, then, in this process your opinion is that the lead is oxidized and passes through the formation of the Pb_2O and forms also PbO, is that right?

A. Yes, on the outside, in contact with excess air, PbO is produced.

Q. Does the Pb_2O, the suboxide, form anything else?

A. In the presence of, or at the elevated temperatures of this very curious unstable substance, by reference to all of our experiments, including the lead oxalate experiments, positively we know dissociates or breaks down into lead and lead oxide, simply because at an elevated temperature, and by reason of the rather large size of the lead atoms as compared, say, with copper or silver, this material prefers to, in the presence of not enough oxygen to form itself, to split itself into the two stable materials, Pb PbO.

Q. You mentioned the size of the particles you found. Does that show you anything in these tests you made of these products?

A. It shows, of course, that the particle size is extremely minute. If we take the lead oxalate experiment, in which there is no grinding, no grinding whatsoever, lead oxalate; we don't grind it at all, start with a powder, or crystal, anything we want to, single crystal, if you wish, decomposes it in a vacuum, with

heat, there is produced there, not by any grinding process at all, by no abrading process or anything of the kind, a very, very fine molecularly subdivided product of lead and of lead monoxide, of course, some lead suboxide also, so that the fineness, we have every reason to believe that the fineness of lead and of lead oxide, and especially of lead suboxide that we find in such a process as this reasonably has been produced, and that the very fine phase crystals, particle size, has been produced by some molecular process, rather than by some mechanical process, it is a general feeling among colloid chemists, based upon experiment, that you cannot grind anything very much any smaller than, let us say, about ten to the minute fourth power centimeters, whereas—

Q. What do you mean by that, ten to the minus fourth?

A. Well, that is .0001 centimeters, one ten-thousandth of a centimeter, whereas in the case of the X-Ray examination of these materials we know that we are dealing with primary crystalline particles which are distinctly in the colloidal range of ten to the minus sixth power.

Q. That is way below any possible size of particle you could get by grinding?

A. Exactly.

Q. I wonder, did you refer to the, in speaking of the various rates, the rate of the oxidation from the PbO to the PbO? I believe you did.

A. Pb_2O to PbO. Of course, then, there is this rate. A further rate we haven't mentioned is the rate of dissociation of lead suboxide into Pb plus PbO, under the proper conditions. Now, the question is why, why can't we have, why isn't there formed a large amount of Pb_2O, why doesn't it stay there? Because it dissociates, and because the whole tend-

ency is in the dissociation form; in the first instance, we can think of an atom of lead, atomic lead, exceedingly fine divided, exceedingly active. The instant that lead is formed, instead of recombining with lead oxide, Pb plus PbO, to give us Pb_2O, this extremely active lead might do one of two things, it might be oxidized again, thus removing it from equilibrium—

THE COURT: I think I will ask you to suspend just a moment.

(Interruption.)

THE COURT: All right.

THE WITNESS: I wish I had a blackboard, I could show these things perhaps more clearly.

THE COURT: We haven't anything like that, have we? We haven't got any blackboards, have we? I don't believe we have.

MR. MORRIS: We have here the equivalent of it, some heavy crayons and paper that you can use.

THE COURT: All right, if you have something there.

By MR. WHITCOMB:

Q. Would you like to show something?

A. I think I can show some of this a little more clearly by writing some of these formulas down.

(Discussion off the record.)

THE COURT: I really don't think this demonstration is worth while going into the record, because it won't mean a thing when you get it written.

MR. WHITCOMB: That is the objection I have to a temporary thing like this.

MR. MORRIS: What is that?

THE COURT: I say it is hardly worth while for the stenographer to take down what he says during this demonstration, because it won't mean anything when you come to read it.

THE WITNESS: I will simply say in words at the same time I am writing—

MR. MORRIS: It might in connection with what he does,—

THE COURT: All right.

MR. MORRIS: — because that might be an exhibit, if it is worth anything.

THE COURT: All right, now, you go ahead anyway you want that will make it clear to me.

THE WITNESS: I am just speaking of this dissociation here between three solid compounds, here is the lead suboxide, Pb_2O, dissociating into lead plus PbO. Now, why don't we have a whole lot of lead suboxide, enormous quantity of it, for example? Of course, the most we have ever formed by heat process has been about twenty-nine per cent. The point is simply this, if one molecule of this, just one single molecule—

THE COURT: Now, try and avoid "this" and "that", if you want your record to mean anything.

THE WITNESS: All right, one molecule of suboxide of lead.

THE COURT: Those words are fatal words when you come to read a record.

THE WITNESS: If one molecule of lead suboxide can be considered to suddenly break apart into one lead atom and one PbO, the reverse process, of course, would be, in order to form lead suboxide, would be for lead to combine with lead oxide, in other words, a reversible process, or equilibrium set up. However, if we remove from this side, from the lead and lead oxide side of this equation, one of the constituents in any way, or change it in anyway, then the reaction of dissociation must proceed away from lead suboxide, it must be in favor, favorable to the dissociation and decomposition of Pb_2O.

Lead can be removed either by attaching itself on to oxygen, to form lead oxide, or lead suboxide, more lead suboxide, or under certain conditions, at high temperatures, those lead particles can be conceived to grow, instead of now being very finely divided and very active, and entering into this equilibrium, those lead atoms may get together and form a little crystal, and thus may actually grow into little balls of lead, no longer active, the active mass of lead is no longer involved in this, those little tiny globules of metallic lead that you see under a microscope, is that process takes place, this annealing process, or grain growing process takes place, it is all favorable to the dissociation of this unstable compound, Pb_2O, just as favorable to its dissociation as if we were taking those lead atoms out with a tweezer, or something of that kind, so that the net result, of course, is that we find only very small quantities, relatively small

quantities of suboxide of lead under the ordinary conditions of operation of these mills, and also under the conditions of dissociation of lead oxide, we produce it in pure form, or essentially pure form, or very nearly pure form only by taking this mixture at low temperatures, and separating it by the super centrifuge.

MR. WHITCOMB: Counsel for plaintiff offers in evidence the sheet used by the witness in this demonstrated talk, and asks the Clerk to mark the same Plaintiffs' Exhibit 30.

THE COURT: Can't we make a smaller exhibit out of it? It isn't very much.

MR. WHITCOMB: It will have to fit in, I imagine.

MR. MORRIS: Can it not be reproduced now by the witness on a smal. sheet?

THE WITNESS: Yes.

THE COURT: You go ahead and write it on this piece of paper, if you really want to keep it, reduce it to boy size.

(The witness copied the formula on to another sheet of paper, which was marked Plaintiffs' Exhibit 30.)

By MR. WHITCOMB:

Q. Now, then, to summarize these rates of actions going on will you please list them? I believe you had a list of eight, or some odd number.

A. There are several rates of reaction going on, one, rate of absorption of gaseous oxygen on lead surfaces; two, rate of removal of absorbed layer by air currents; three—

Q. Now, then, number two, did you refer to that before?

A. Yes, the third I didn't, I think three. The rate of cooling by the air blast.

Q. Please elaborate on that a moment.

A. We have at first—

THE COURT: You sort of covered those two in the second stage—

THE WITNESS: Yes.

THE COURT: — that you were talking about before.

THE WITNESS: Yes, that is right. The heat is being evolved, of course, in the oxidation process, one mole of PbO is accompanied by fifty thousand calories, approximately, approximately fifty thousand calories of heat, and obviously all of these rates are going to be conditioned, determined in part by the actual temperature condition. Now, the air going in as a blast obviously has an effect upon temperature of these surfaces of the lead, and so on, the unchanged lead ball, so that simple rate is one of the essential features, the rate of the, actual rate of cooling of the mass and of the surfaces by the air blast as it passes over and through and around the various particles during the operation.

By MR. WHITCOMB:

Q. Does that prevent the temperature from rising too high?

A. It would tend to do that, yes.

Four, the rate of oxidation of metallic lead at a given temperature. That, of course, means the superficial oxidation to suboxide.

Fifth, the rate of diffusion of oxygen through the oxidized layer.

Sixth, the rate of removal of the protecting layer by the mech ical abrading action, depending on the size of the balls, the rate of rotation of the drum, the amount of charge, temperature, and so on.

Seventh, the rate of dissociation of lead suboxide, Pb_2O, to lead plus PbO.

And eighth—

Q. Does that involve this equilibrium theory—

A. It does.

Q. — you have just discussed?

A. It does; and eighth, the rate of oxidation of Pb_2O to PbO, tetragonal.

Now, do you want to refer to the original question? Is that what you want me to do now?

Q. Yes, now, you remember we started this discussion by reference to the patent 150, and please state now, does this apply to that disclosure, as you understand it?

A. It is easy to maintain harmony of oxidation of the surface of the material, lead, and abrasion of oxidized lead. It seems to me that the word harmony is an exceptionally cogent and excellent method of describing the complex types of things that are going on, these parallel and subsequent reactions, one after the other, going on together, all of these things working together or against each other, and in order to—since there are at least eight of these, all different rates, it follows that any satisfactory process must represent a harmony of these various things in order to produce satisfactory results.

Q. By the way, I forgot to make the standard inquiry as to whether or not you have studied all these patents in suit in detail and are familiar with them. I assume you are?

A. I am.

Q. Now, will you please refer to the subject matter set up in the claims of the 150 patent, and state whether or not, for example, some of these claims, 1, 2, 3, 4 and so forth, specify this combination of processes going on as you have described it.

THE COURT: Now, what patent are you going to take up?

MR. WHITCOMB: 150, I started with.

THE COURT: All right.

MR. WHITCOMB: Take claim 1, for example.

THE WITNESS: "A process of manufacturing a fine powder of lead suboxide intermingled with powder of metallic lead, comprising in putting pieces of metallic lead in a rotatable vessel in a dry state, introducing into the said vessel currents of an oxidizing gas to oxidize the surface of the lead while rotating the said vessel, and abrading off the oxide formed on the surface."

It seems to me that fits into this description which I have given. We recognize that in the final product clear, outside of the mill, that there is only a small proportion of lead suboxide, because, by virtue of the dissociation of lead suboxide into metallic lead and PbO, but if we take into consideration the fundamental mechanism going on within the mill I should say that this describes that process.

By MR. WHITCOMB:

Q. Refer to a claim such as claim six, for example.

A. "A process of manufacturing a fine powder of lead suboxide intermingled with powder of metallic lead, comprising in putting in a rotatable vessel pieces of metallic lead, introducing air thereinto and rotating the vessel maintaining the temperature of the material at not less than 60° C. by the heat generated by friction and chemical reaction."

I would say the same thing precisely about that claim.

Q. Do you find that the normal operation of a process of this kind does raise the temperature up to a minimum at least of that sixty degrees specified in that claim?

A. It does.

Q. Sixty degrees C. is what in Fahrenheit, about?

A. Let's see—104, is that right?

Q. 140?

A. Yes, 140, that is right.

Q. Now, refer to claim 8 of this 150 patent and state the same thing.

A. "In the production of a finely divided mixture of lead suboxide and metallic lead, the step of tumbling together and agitating, a mass of hard heavy material containing metallic lead, while maintained at a temperature between about 60° C. and about 200° C."

That presents a range of temperatures through which this process can—a whole range over which such a process can be expected to operate. These various rates of the eight different kind of rates are, of course, differently affected by the temperatures, by the temperatures of the reaction, by the amount of cooling, and so forth, and within those ranges, of course, the product will simply have a different proportion of oxidized material.

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Q. Now, as to claim 9 what do you find, and will you state the same thing with respect to it?

A. "A method of forming a finely divided powder containing a large proportion of oxidized lead which comprises impinging a current of air on lead masses in a dry state, abrading the lead masses, and controlling the temperature to obtain a finely divided powder containing a large proportion of oxidized lead."

That is, it seems to me, the best statement we have.

Q. Does that bring out this dissociation theory that you have advanced?

A. I feel that it does. It speaks of a large proportion of oxidized lead. Of course, there is no specific mention of the—of what kind of oxidized, or degree of oxidation. That we know.

Q. It does not limit it to the suboxide?

A. It does not.

Q. In your opinion what proportion of the material made in this process goes through the suboxide stage?

A. Of course, an exact estimate of that is exceedingly difficult, but I should say that, judging by the distribution of particles sizes, activities, and so forth, that initially—that a very large proportion of the change was gone through that stage of suboxide. We have indicated the different types of lattices. How rational it is that oxygen should first combine itself with lead, as we have indicated for the cubic Pb_2O lattice; but the conditions of temperature and rate of abrasion, and so forth, even though ninety per cent. or so should go through that stage, of course, that does not necessarily mean that there should be ninety or a hundred per cent. of lead suboxide in the final product.

Q. I notice in some of these claims, such as one and four, and nine, several references made to the fact that the masses are in a dry state. Please state what function that has in this process.

A. The whole process, of course, is a dry process, in which water is not involved, because if we did have water the probabilities are that we would have an entirely different course of reaction, mechanism.

Q. Then you regard that requirement as an essential feature, as a fundamental item involved in the processes?

A. Yes, although that does not—I do not mean to say that the presence of humidity, presence of water vapor in the air would in anyway vitiate the results or give you any essentially different end product, provided that that humidity was kept within reasonable limits.

Q. Will you now please refer to the 149 patent? I notice the title of this patent is "Method of Manufacturing Metal Powder", and bearing in mind what you have already described as to the process of 150 patent, state to the Court your understanding of the 149 patent, using this large exhibit chart which has been produced as Plaintiffs' Exhibit number 13.

A. I feel myself that when we speak of lead powder in this particular patent that it in no way means that we have a different process, that we have formed metallic lead to the exclusion of anything else, that no oxidation is taking place, or that such a process could proceed by a method or mechanism different from what we have indicated for the 150 patent. It is entirely possible by the proper control to obtain a product which is very high in very, very finely divided lead, pyrophoric lead, as a matter of fact, by pyrophoric lead we mean a product containing sufficient metallic lead in sufficient quantity that it will

spontaneously ignite upon access to oxygen, and consequently the generic term "lead" used here simply, it seems to me, refers to a product which has gone through the same fundamental oxidation process, but which may have or may not have a large proportion of metallic lead.

Q. In your opinion how is the metal lead powder produced in the process shown in the patent 149?

A. In the first place, metallic lead is formed by the dissociation of lead suboxide.

Q. As you have just described?

A. As I have described it. It is entirely conceivable, of course, that in the detaching of a thin, a very brittle, oxidized layer, that small particles of lead would also be disengaged, particularly as they cast, from cast pieces, where the crystal grains are quite evident. I do not believe that the oxidation process precludes the possibility of producing lead by breaking it off or chipping it off.

THE COURT: Are you addressing yourself to the fact that the claims of 149 refer to lead powder, is that what—

MR. WHITCOMB: Yes.

THE COURT: In other words, you are meeting the possible argument that the means just your lead powder, is that—

MR. WHITCOMB: Yes.

THE COURT: Is that the point?

MR. WHITCOMB: The claims, of course,—

THE COURT: Well, you say, of course, it means any oxide of lead, as well as lead.

MR. WHITCOMB: We say the patent means

the lead, but the process going on may incorporate these other features of the 150 patent.

THE COURT: You don't think that a lead powder, the word "lead powder" can properly describe an oxide of lead powder?

MR. WHITCOMB: No, that is it, and further, we are not contending that it may not include the oxides as well.

THE COURT: Yes; oh, I don't know.

By MR. WHITCOMB:

Q. In connection with the formation of a lead powder did you hear Mr. Ishimura's reference to the treatment of lead balls in a CO_2 gas?

A. I did.

Q. Do you agree with the results that he indicated as obtained in that method?

A. I do. We have conducted independent experiments, both in vacuum, in nitrogen, and in CO_2, in an effort to produce a large quantity of pure metallic lead, very finely divided, and these were done with ball mills, rather rough experiments, it is perfectly true, but in general I would agree with the contention and with the experiment, that an oxidizing atmosphere is essential to the production of a powder in any quantities at all.

By MR. MORRIS:

Q. At any temperature, Doctor?

A. Well, of course, what Mr. Ishimura had was at room temperature. We made some rough experiments at elevated temperature, say at 212 degrees Fahrenheit, and using—using balls in an ordinary ball mill, not reproducing a mill, a mill like this at all, we have no such opportunity: that is, even at elevated temperatures, that is, in inert atmosphere, in vacuum,

that works best, or nitrogen, or CO_2, the balls just tended to polish each other.

By Mr. Whitcomb:

Q. Will you now just briefly refer to claim 1 of the 149 patent and state whether or not you find in these processes that a finely divided chemically reactive lead powder of such fineness and activity as to be readily changed chemically on contact with air is produced.

A. It is produced. I have observed samples of material prepared in Japan, which is extremely chemically reactive, under the condition in which the particular powder was made, in the sense that it particularly when slightly moist oxidized, changed color in air very, very rapidly.

Q. I assume from your previous discussion that the other recitations of claim 1 with respect to the introducing of the lead and rotating the vessel and the attrition also takes place, is that right?

A. Yes.

Q. Will you please next refer to the 151 patent, and plaintiffs' chart exhibit P-15, and state the same thing with respect to the substance of this patent?

A. This patent and apparatus and machinery provides for exactly the same mechanism which we have been discussing, rotation of balls, the production of a current of air, oxidizing air going into the drum, and the formation of a powder containing lead, lead oxide.

Q. Will you please refer to the claims of the 151 patent and state what is brought out in this patent particularly?

A. "The process of forming finely divided oxygenated lead compounds which comprises treating a finely divided chemically reactive powder comprising a major portion of lead suboxide with an oxidizing substance."

That is precisely what I have been indicating all the time, namely, that lead suboxide easily oxidizes to PbO. Of course, it is conceivable if we went to very high temperatures we might have other oxide, but under this range of temperature we have the tetragonal form of lead oxide, and experiment indicates that this finely divided oxygenated lead compounds, it is possible in these mills, just as it is with the powder, the black powder formed from lead oxalate, to expose to oxygen or oxidizing agents and to end up with precisely the same result as regards the quantity of PbO, the quantity of lead, in fact, you can produce a hundred per cent PbO under the proper conditions.

Q. I notice that claim 2 of the 151 patent includes the requirement "maintaining the reaction by the evolved heat of reaction". Have you found that present in these processes?

A. Yes, yes, that is what carries the reaction on, all these reactions, with sufficient rapidity so the product is formed in a reasonable length of time.

Q. And as I understand your testimony to be, this going on in the mill and practically cannot be stopped, is that right?

A. Absolutely not, this fine powder which has been abraded off is surrounded with a large excess of oxygen all the time, with air, it is being carried by air out, in fact, in this particular modification, and the conditions are absolutely perfect that the reaction should keep on going on until the material is chilled down or made cold, so that it stops.

Q. All right, will you now, then, refer briefly; now, at least, to the patent on the plates, 1,584,479, and state in the record your opinion of the essence of the disclosure of this patent?

A. The first claim, preparing plates for storage batteries, reducing metallic lead to a fine powder, ex-

posing the powder to the air, which, of course, produces the oxidation process of which you have been speaking, kneading the mixture into the form of a paste, and so on, and so on, the drying, drying same thereby to convert the lead suboxide into lead hydroxide—that is the process which is being used successfully in making storage battery plates.

Q. From what material?

A. From material taken from mills of this kind.

Q. Will you please refer to page 1 of this patent, particularly in the reference to the counteracting of the shrinkage, in lines 40 and 41, and state your opinion of that action?

A. I think that that is essentially correct, from the [illegible] from any knowledge that we have of any experiments which we have performed. The presence in the powder of an exceedingly finely divided phase, solid phase, is very advantageous in this particular. I would, under lead hydroxide, of course, I would want to include also such compounds as 3PbO, 1H20 and other basic hydrated oxides, I think that the lead hydroxide could be construed to include any of these known, definite compounds.

Q. Now, will you please turn to the drawing of the defendant's plant as submitted in the report by Dr. Wilson, Exhibit 20, and explain to the Court how in your opinion the apparatus and the operation thereof comes within the essence of these patents, as you have been discussing them today, particularly starting, say, with the 150 patent?

A. As I understand it, we have a vessel, a rotating vessel, into which is placed a series or a combination or mass of balls, this mill being caused to rotate, and a current of air passed through the mill, at the same time, as an oxidizing medium. The product formed by the processes of oxidation of the surface of the lead balls was examined by X-rays, microscopically,

THE COURT: Where is the fan?

MR. WHITCOMB: Why, up at the end, here, sucks it through.

THE COURT: Oh, this is a suction arrangement, not a blower.

MR. WHITCOMB: No.

THE COURT: All right.

MR. WHITCOMB: The patent says it can be a suction, too.

THE COURT: All right, go ahead.

THE WITNESS: The atmosphere, the air, atmospheric air and oxygen reacting, oxidizing the surface of the lead balls, which are being tumbled or rotated in this mill, maintained at an elevated temperature, the product is then received through suitable screens, and so forth, into collectors.

The essential features, it seems to me, are the bringing together in a rotating mill lead balls or lead pieces in an atmosphere of oxygen, causing to ensue the various reactions which we have been discussing, the abrading action taking place by the rubbing of these balls one upon the other, and the collection of a product consisting of lead monoxide, metallic lead, and small quantities of lead suboxide.

By MR. WHITCOMB:

Q. What about the amounts of lead suboxide in the drum itself, in your opinion?

A. I think that the lead—the process of oxidation and abrasion of those lead balls is going through a lead suboxide stage practically completely, just as we have indicated before.

Q. In connection with the patents in suit?

A. Yes.

Q. What have you to say about those eight, I believe it was, rates of harmonizing—

A. Those proceed—

Q. Harmonizing reactions.

A. Those proceed just the same, that is, all are involved in this reaction in just the same way, there is no feature to eliminate any one of this combination. Of course, this gives the conditions, the final product, as far as the constitution of the various components.

Q. I notice that this is, the drum itself is entitled Hardinge mill; what have you to say of that as compared with the cylindrical mill shown by the patents in suit?

A. Well, to me the essential features, irrespective of the size or shape of the outside of the cylinder, whether it has a double cone, or a straight cylinder, is that of exposing in an oxygen atmosphere metallic lead surfaces, and abrading those off by rotating, abrading process.

Q. But actually the Hardinge mill has what function, if anything, different from the cylinder, does it add to this?

A. The theory of this double cone, of course, is that there is a certain degree of mechanical action involved, partly centrifugal, in which there is a classification of powder.

Q. Would this process operate if you shut off the air, in your opinion?

A. I do not believe that a satisfactory process would operate in the absence of air.

By The Court:

Q. Well, you couldn't get the powder out if you didn't have air, could you? How would you get the powder out of the mill at all?

A. Well, I don't see how you could, either.

By Mr. Whitcomb:

Q. Of course, what is the function of the inclined plane, as far as the powder getting out is concerned?

A. Well, the theory of the Hardinge mill, of course, is that there is a certain mechanical creeping action which throws out the—

By The Court:

Q. Well, it would just dribble out, but there wouldn't be any separation into the finer—it would all come out ultimately, wouldn't it?

A. Well, it would, of course, if it were tilted enough.

Q. But it would not be a very satisfactory operation without the air?

A. No, I shouldn't think so.

The Court: Well, I think we will recess for ten minutes.

(Recess at 3.25 o'clock P. M.)

After Recess.

George L. Clark, recalled.

Direct-examination (continued).

By Mr. Whitcomb:

Q. Will you please refer to Dr. Wilson's report on the beginning of the part entitled Section 3? It is on page 5 of the report: pages 9 and 10 of the type-

written report; and state what you find that are the actual figures for the change in the test described where the material was left to stand twenty-four hours, and analysis showed 94.65 per cent lead which was previously found to contain 95.48 per cent lead, and explain in detail your method as you go along, if you please?

A. Dr. Wilson has calculated from the percentages correctly. That is the final product we have 36.9 per cent metallic lead calculated as metallic lead, and 63.1 per cent calculated as lead oxide. Did you want a calculation on the next page, that is an explanation in which there has been an increase in weight?

THE COURT: He let that stand, he says, for twenty-four hours; then he found it contained 94 less lead.

MR. WHITCOMB: Therefore, what?

THE COURT: He says the change would indicate oxidation of some metallic lead.

By MR. WHITCOMB:

Q. We will try to figure that out, Dr. Clark; you can give the figures on that?

A. Oh, yes.

THE COURT: Where does all that tie in with Dr. Clark's theory of lead sub-oxide?

THE WITNESS: Your Honor, this is, of course, a straight chemical analysis made by ordinary methods of quantitative analysis in which the results have been calculated Pb and PbO.

By THE COURT:

Q. In other words, 94 and 65 per cent lead does not necessarily mean all pure metallic lead?

A. No, it doesn't necessarily mean all pure PbO; that may not include lead as lead sub-oxide, also. You see, the actual quantity in this analysis, the actual proportion of lead sub-oxide is unknown, and the chemical analysis of this type would not differentiate between lead sub-oxide and lead oxide; that is, with these available figures.

The change from 95.48 to 94.65 per cent of lead, while that seems to be a very small amount of lead, yet because—I mean a very small decrease in the lead content, is actually because of the high equivalent weight of lead quite appreciable. We can illustrate that most easily in this next experiment down here. For example, we take a powder 8.1321 grams.

Q. He said exactly what you said: the high weight of lead should be taken into consideration.

A. Yes, the middle paragraph on page five of the printed record we have this experiment, 7.216 showed increase of .0778. Now, if we take those figures, the .0778 must represent all oxygen, an increased weight of oxygen. We have 63.1 lead oxide, and 36.9 of lead in those 7.216 grams, it will give us in the sample 2.665 grams of lead in his sample; that is, in this sample of 7.216.

Now, .0778 grams of oxygen are combined with just about one gram of lead to produce lead oxide, PbO, and we will, therefore, have 1.665 grams of lead left in the product after oxidation, which is twenty-two per cent of lead still present. In other words, in that fine in the increased weight, the lead has increased from 7.9 to 22 per cent, a change, you see, of about 15 per cent in the total percentage of lead, all of which indicates that a powder of this kind will undergo still greater oxidation when exposed to air; the lead will go over to lead oxide.

By Mr. Whitcomb:

Q. Will you explain to His Honor the one thing in connection with Claim 1 of the 49 patent which uses the term chemical active powder, when it comes in contact with air? That is what we are explaining here. Take it from the other angle and consider that, and show what increase in percentage of PbO was obtained in Dr. Wilson's report when he let the sample stand for twenty-four hours?

A. The PbO content increased 63.1 per cent to 74.6 per cent in twenty-four hours.

Q. And increase of what percentage?

A. That is an over-all increase of 11½ per cent.

Q. Do you consider that a substance that readily changes when in contact with air, in view of those facts?

A. I would say that 11½ per cent is an appreciable amount, and represents the fact that this material is still reactive even though it may be covered over with PbO.

Q. In order to have the record complete, will you put in that formula you used to obtain that?

A. Yes. In the calculated form a given percentage of lead determined by chemical analysis, let X equal the fraction of free lead; then one minus X is the fraction PbO. We then take the proportions of atomic and molecular 20.72 for the atomic weight of lead divided by 223.2, which is the molecular weight of PbO, times one, minus X, plus X—that is, that is the fraction of lead in PbO—plus the fraction of lead, free lead, equals the percentage, and we calculate one minus X.

Q. And you got what figures?

A. This particular calculation I have made here is simply to confirm Dr. Wilson's original value, 36.1 per cent of lead, 63.1 per cent of PbO. We use the

same method to calculate the 74.6 per cent of PbO, which is formed after twenty-four hours.

Q. Now, will you please refer to the 150 patent, and this chart, Plaintiffs' Exhibit 14, and take the patent? I want to be sure you find the exact and particular foundation for each of the parts. Will your mind going right through it so we will have that in the record, why you say this drawing does represent the apparatus described in the specification, which contains no drawing?

THE COURT: I thought he did do that.

MR. WHITCOMB: I think he didn't.

By MR. WHITCOMB:

Q. For instance, this rotary feed, do you find anything like that?

A. Any condition, any device that you want, if I remember rightly, so that you supply lead pieces to the rotatable vessel.

Q. As to the other features, you feel you have already covered that?

A. I have already discussed that.

Q. In connection with the active of this material that you referred to and pointed out these changes, would you give some idea to the other product, the chemical materials that are produced; did they change that rapidly, a change of eleven per cent, say, in twenty-four hours' standing?

A. Well, in my mind there aren't very many substances which oxidize so readily. It is conceivable, and undoubtedly is true that exceedingly finely divided iron powder would oxidize to rust on exposure to air. Of course, we know that certain other very, very active materials like soft pure metals such as sodium, potassium and calcium, and so on which very easily oxidize. We can't keep them in air at all without oxi-

dation; they change very rapidly. Other substances, however, are the normal oxides, salts most of them are ordinarily quite stable. There are lots of organic and biologic materials which are not stable in air.

Q. Now, there are some general questions we would like to ask. For example, what have you to say about why there is any sub-oxide in the final product of defendant's mill, or plaintiffs' embodiment thereof, of the patent in suit if it goes through this dissociate theory that you have announced?

A. In the first place, we do say upon the basis of that equilibrium theory, we do set up an equilibrium which would enable us under given temperature conditions, that is, the room has an elevated temperature over a certain length of time, a certain proportion of one associated Pb_2O; then, also, Pb_2O is protected, oftentimes entirely coated over; it is protected, coated over, and thus preserved against it.

However, the microscopic examination demonstrates its actual presence there. I think these two other given equilibrium conditions, the given equilibrium under the two conditions, time and temperature, and the exposure over that time to air, to oxygen.

Q. In Plaintiffs' Exhibit 26, which is the chart illustrating the films that you have introduced by way of exact illustration, where and how much more, if that be the case, do you show that there is Pb_2O in the mill in the products examined as taken from the mill as compared with the end product finally obtained out of the mill?

A. That is best shown, of course, by these films, D5, which represent the layers under the outside coat on the ball, itself. There is the increased concentration there, and undoubtedly the material is stabilized by being in contact with the metallic lead and protected from further oxidation by the outside layer to PbO.

Q. That is the length of what line here?

A. The center line in all cases.

Q. You compare the length of this center line, say D52, with what on that chart to compare it with the percentage in the final product?

A. Compared with any center lines of any of these to the D1's, D3's, and so forth. This attached table gives the actual numerical values.

For example, on one sample, D1, the fine fraction after sifting, 7.3 per cent; course fraction, 4.8, and the ordinary unsifted product, 5.67. In all cases, the finer fraction from the mill after screening contains the largest proportion of the suboxides of lead. On the ball, D52, we find a maximum concentration of 14.6 lead suboxide in the protected layer underneath the exterior.

Q. I hope this isn't repetition, but I wondered if you explained fully why there was no chemical process for analyzing for Pb_2O in these products at the very outset?

A. Of course, Pb_2O has not been known in a pure form; it has never been isolated so that people could study those peculiar reactions.

Pb_2O undoubtedly has similar volubilities. When you go to try to separate lead from lead oxide, Pb_2O could be exposed to go into solution; you couldn't separate it by any differential volubility method. You can't get it away from PbO, and since you can't get it in a separate phase, of course, you can't analyze for it. If you could do that, then the only suitable method, the analysis would show you had lead and oxygen in it. You would then have to proceed to a molecular weight determination to show it was two items of lead to one of oxygen. For that reason it is so important to use these newer distinctive physical methods which distinguish it, its X-Ray picture, its appearance in the microscope, and so on.

By THE COURT:

Q. But you separate by your centrifuge, do you?

A. Yes.

Q. That separates it?

A. Yes.

Q. How long has that apparatus been in existence?

A. The centrifuge in its present form is a comparatively new apparatus; that is, the one that will operate at fifty thousand r. p. m. The Sharpless people make one now—that is, the cream separator people—and, of course, it has required the advent of these new very fine stainless steels in order to hold together fifty thousand r. p. m. It has to be constructed with extreme care. It is a comparatively small apparatus, but just the centrifuge part of it costs about a thousand dollars.

Q. How long has that been available for use?

A. So far as I know, in the last three or four years. The one we have is brand new.

By MR. WHITCOMB:

Q. Did you make any prior attempts to centrifuge this material?

A. We tried with ordinary methods; that is, with the ordinary centrifuge such as the chemist's laboratory has, but without any particular success.

Q. It was only how recently tested?

A. These tests were conducted in August, the latter part of July and August.

Q. Of this year?

A. Yes.

Q. With this expensive centrifuge machine?

A. Yes.

Q. Have you any photographs of your X-Ray machine?

A. This is an exact photograph of the apparatus

upon which all this X-Ray work has been done, and the camera may be seen at the back, a cylindrical camera used for the purpose of examining these.

Mr. Whitcomb: Counsel for the plaintiffs offers in evidence the photograph, and asks the Clerk to mark the same Plaintiffs' Exhibit No. 31.

By Mr. Whitcomb:

Q. What does the particle size of metallic lead in the final product indicate with respect to the sub-oxide in the mill?

A. We have indicated that already, namely, that the next to the finest fraction as we can separate into various fractions by the centrifuge, the next to the finest fraction is a fraction of nearly pure metallic lead. There is some little lead oxide in it. And that, of course, indicates that there is present a large amount, a large proportion of metallic lead, actually in a very finely divided stage.

There is also the very coarsest fraction thrown out; that is the first fraction that comes off, a coarse fraction of lead, little tiny pellets. The longer this material is kept at an elevated temperature the larger these particles of lead become, so that the presence of acid, finely divided lead would have a bearing, it seems to me, upon the validity of a molecular type of process in which a molecule is broken apart.

Q. When you were talking about this analysis reaction going on in the process 150 patent, is it your testimony that in your opinion that was involved in an invention?

A. Yes.

Q. And you have talked about your understanding of the operation of defendant's mill both from the drawing and from Dr. Wilson's report; is it your opinion that their operation involves the process incorporated in this invention?

A. I can't see any distinction whatsoever so far as fundamental process of the mechanisms is concerned. The analysis of the materials from the Shimadzu's mill such as is obtained from the mill operating in Indianapolis, and the Exide material as provided by Dr. Wilson are practically not distinguishable.

MR. WHITCOMB: Direct-examination closed.

Cross-examination.

By MR. MORRIS:

Q. Do you mind telling me, Dr. Clark, the substance of what you said a moment ago about your inability to distinguish chemically between PbO and Pb_2O?

A. I mean by that simply that any ordinary type of chemical analysis which requires that the material shall be dissolved, be put into solution and precipitated as lead sulphate, or any other approved method of quantitative analysis, could not directly give you a distribution between lead oxide and Pb_2O; both of them would dissolve.

Q. But when you isolate one half, if it exists, you could analyze it chemically, could you not?

A. Yes.

Q. Did you?

A. We did.

Q. How?

A. This very tiny part of material we had was dissolved and quantitatively measured; I mean the quantitative analysis for lead was made.

Q. Do you have that quantitative analysis with you?

A. I think I have it here somewhere, yes. With this sample, of course, the refractive index and the X-Ray patterns were made.

MR. WHITCOMB: Counsel for plaintiffs didn't know he had any additional tests, or he would have asked for them on direct.

THE WITNESS: I am sorry; I don't seem to be able to put my hands right on that. I have some of our original calculations here, but this was on another sheet. I will have to find it.

By MR. MORRIS:

Q. Have you a separate and distinct recollection as to what you did and the results that you obtained chemically?

A. Well, the results showed not quite pure—

Q. No, won't you answer me first?

MR. MORRIS: Will you read the question?

(The question was repeated by the reporter as follows:

"Q. Have you a separate and distinct recollection as to what you did and the results that you obtained chemically?")

A. Yes, I have.

Q. Will you be good enough to give me your recollection, and then I will let you supply me with the data tomorrow morning?

A. Yes. This material was analyzed for lead.

Q. How?

A. By the lead sulphate method.

Q. Which is what?

A. Solution of given weight of the material.

Q. And what was your weight?

A. Well, of course, these figures I don't remember in detail.

Q. Three or four pounds?

A. Oh, no. It was only a few milograms because of the small size of the samples; about a tenth of a gram.

Q. And about twenty-eight or twenty-nine grams in an avoirdupois ounce; am I right?

A. Yes.

Q. And it was about a tenth of a gram?

A. Yes.

Q. So it was about one two hundred and ninetieth of an ounce?

A. Yes.

Q. Was that the sum total of the material which you have designated as Pb_2O which you got by this centrifuge?

A. Not all of it. A portion of it had been used for X-Ray work, and a part for the microscopic work. Because of the size of the centrifuge in any given run it is fairly small.

Q. Out of all the exhibits that were given to you you got a gram of Pb_2O, as you designate it?

A. Yes.

Q. Or thereabouts?

A. Yes.

Q. Let's go back to our analysis. You took a tenth of a gram of your product, of your centrifuge—is that term accurately used by me?

A. Right.

Q. And you subjected it to chemical analysis consisting of what?

A. Dissolved in acetic acid, and, of course, the solution very greatly diluted, and then a precipitation made of lead sulphate, and the material weighed as lead sulphate, from which we calculated the lead.

Q. And the remainder of your analysis consisted of what?

A. Well, that is the only part of the analysis in-

volved; it is simply a quantitative analysis of the material for lead.

Q. You did not weigh your oxygen?

A. I did not.

Q. Then how do you know it was oxygen?

A. Simply because there was no—oxygen could have been determined by combining with hydrogen and weighing with water, and so on—the tests were conducted or permitted from this substance, simply warming this substance in the presence of air, and the practically pure, easily recognizable yellow PbO was produced by its oxidation.

Q. The difference of weight of oxygen in PbO or tetragonal litharge calculated as Pb_2O would be what?

A. I will figure that out in just a minute. PbO has a lead content of approximately 92.7 per cent; Pb_2O, a lead content of about 96.3 per cent.

Q. So that the difference would be approximately four per cent in oxygen content of a tenth of a gram where the weight of the lead in a tenth of a gram would be of the proportion of that calculated as PbO, and of the proportion calculated as Pb_2O?

A. Well, let's see: 93 per cent of one-tenth. Oh, 93, and calculate all as sub-oxide: .093, .0963.

Q. I thought you were still calculating; your final figures are what, Dr. Clark?

A. .93 calculated—that would be the weight in lead oxide; .0963 in sub-oxide.

Q. .0963 what?

A. That would be the weight.

Q. Of the lead?

A. Of the lead.

Q. In a tenth of a gram of your original material so that your oxygen would represent the difference; that is, those figures represent nine pins one-hundredth of a gram while your oxygen would represent

what percentage of the weight? About one plus a hundredth of the weight?

A. Yes, and lead oxide would be about a hundredth of the sub-oxide, calculated as sub-oxide about four one thousandths.

Q. So the difference in the weight of the oxygen which would be found in a tenth of a gram of your material, if it were Pb_2O and PbO it would be what?

A. The weight—

Q. Expressed in grams?

A. In grams as lead?

Q. As oxygen; the difference in the weight of the oxygen in grams?

THE COURT: 6 one-thousandths, isn't it?

By MR. MORRIS:

Q. You mean one tenth minus .093 would be the weight of the lead—

A. One would be 7 one-thousandths.

Q. 7 one-thousandths?

A. Yes.

Q. This would be the difference between the two?

A. No, that would be the oxygen as PbO; the sub oxide would be one tenth minus .0963; 37 ten-thousandths.

Q. So, had you weighed your oxygen you would have had to be correct within one thirty-seven ten-thousandth of a gram to determine whether you were dealing with PbO or Pb_2O?

A. Exactly.

Q. Did you endeavor to obtain the heat of reaction with respect to any of your so called Pb_2O?

A. Heat of reaction, may I ask do you mean heat of oxidation, or what?

Q. In any way; calorimetric reaction?

A. We made no calorimetric measurement.

Q. The only test you subjected your so called Pb_2O to were, one, a partial chemical test consisting of the treatment of your product with acetic acid and then with sulphuric acid, and then weigh the lead sulphate; that was the beginning and ending of your chemical test of this Pb_2O?

A. It was simply because these—

Q. I am sorry; pardon me.

A. —because the high equivalent weight of lead makes the chemical analysis for it very difficult, so relatively easy to misinterpret.

Q. So far as you know, now, no one ever born on this earth has ascertained the existence chemically of Pb_2O?

A. I shouldn't say that, no, I am not certain of that.

Q. Won't you identify the man?

A. I don't know the man.

Q. I said so far as you know; that was in my question?

A. Oh, yes.

Q. Does that change your answer?

A. I might say in answer to that in chemical literature you can find not only chemical analysis for lead sub-oxide, but heats of reaction. One man finds, for example, positive heat of PbO to Pb_2O; one finds negative reaction. One of these men was, I believe, a man by the name of Tanatar.

Q. And another was Hershckowtsch?

A. Yes.

THE COURT: Do you want to go on to five o'clock?

MR. MORRIS: I think so.

THE COURT: It is all right to me.

By Mr. Morris:

Q. That is the only answer you can give to the question I asked?

A. Absolutely.

Q. Will you examine, please, Plaintiffs' Exhibits 13, 14, and 15, and as I understand it, you have testified that they truly represent a machine disclosed, respectively, at patents 149, 150 and 151; that is, any person could make those machines from the disclosures in those patents, as I understand it?

A. I think so in the essential details.

Q. There isn't any question about it, is there, Dr. Clark?

A. No.

Q. What is there disclosed in the patent 020 which is not disclosed in patents 149, 150 and 151?

A. I haven't any copy of 020 here; I will have to refresh my mind.

The Court: What is the question?

(The question was repeated by the reporter as follows:

"Q. What is there disclosed in the patent 020 which is not disclosed in patents 149, 150 and 151?")

Mr. Morris: Read the question before that.

(Questions and answers were repeated by the reporter as follows:

"Q. Will you examine, please, Plaintiffs' Exhibits 13, 14, and 15, and as I understand it, you have testified that they truly represent a machine disclosed respectively, at patents 149, 150 and 151; that is, any person could make those machines from the disclosures in those patents, as I understand it?

A. I think so in the essential details.

Q. There isn't any question about it, is there, Dr. Clark?

A. No.")

THE WITNESS: In Claim No. 1—

By MR. MORRIS:

Q. I am not speaking about claims at the moment, Dr. Clark; I am speaking of the disclosures, the essential disclosures.

A. There is no difference in the essential disclosures as respecting a mechanism production.

Q. Then the claims of 020 are for specific narrow features, I take it?

A. If I remember rightly.

Q. Will you point out the particular detail that you now have in mind that is not covered by the illustrations which you say are in Plaintiffs' Exhibits 13, 14, and 15 that are not disclosed by patents 149, 150, and 151, the claims in issue being 10 and 11; you need not trouble yourself by any of the others?

A. Claims 10 or 11; I can't see any new features which are not included under these other claims.

Q. My understanding is, then, you find nothing in either claims 10 or 11 which is not fully disclosed by patent 149, again by patent 150, and thirdly by patent 151; is my understanding correct?

(No answer.)

Q. I couldn't find any, Dr. Clark, if that helps you any; but if you can, will you put your finger right on it?

A. Well, I don't; I don't see any essential difference. Of course, it does make a separate statement here to the effect, "and means associated with said

apparatus in which said lead suboxide may be converted into litharge while still in its dry state."

Q. Do you mean to say you don't get—

A. Oh, you do.

Q. Out of apparatus disclosed by your exhibits, 13, 14, and 15?

A. Sure.

Q. Dr. Clark, in Plaintiffs' Exhibit 21, being this series of photograms—what is your technical word?

A. Diffraction.

Q. Diffraction pattern; all right; what pattern on this Exhibit 21 most nearly resembles either 9, 10, or 11?

THE COURT: 9, 10, or 11?

MR. MORRIS: Perhaps my question is not clear. I will withdraw it and put it again.

By MR. MORRIS:

Q. Which of the patterns other than 9, 10, or 11 on your Exhibit 21 most nearly resembles in your opinion, either 9, 10, or 11?

A. Of course, none of them. All of the other patterns except the pure substances at the top, which are for reference purposes. All the other patterns contain lead and lead oxide in addition. The bottom pattern prepared by decomposition of oxalate has the greatest amount of the most intense lines corresponding to 9, 10, and 11. The next most intense lines are to be found in No. 13, which is within the inner surface of a lead ball taken from the Exide mill.

By THE COURT:

Q. Where did 14 come from?

A. 14 is by decomposition of lead oxalate.

Q. Not from the mill?

A. Not from the mill, no.

By Mr. Morris:

Q. Now, then, Dr. Clark, you answer me in terms of intensity. Do you mind answering me in terms of dimensions, and presence of lines?

A. I don't know whether I understand what you mean by dimensions.

Q. I mean distances between planes, interplaner spaces or distances; do you understand the lines indicating that is an X-ray spectrum?

A. Yes. These spectra are composites, all on the same photograph, all diffraction from many sets of plates simultaneously.

Q. Right. But those spectra are visible, of course: that is, you can see them?

A. Yes.

Q. Do you find any of the lines that are diffraction patterns, 9, 10, or 11 on Plaintiffs' Exhibit 21 in any of the other spectrograms in Exhibit 21?

A. We do.

Q. With which other spectrograms on Exhibit 21 do you find the lines most nearly superimposed?

A. With the exception, as I have mentioned before, of a few very relatively weak lines. Due to another substance unidentified in very small amounts in 9, 10, and 11, this pattern can be and is superimposed on all the others. Of course, it shows that many of the lines follow on top of each other; that is lead oxide and lead.

Q. Then what you have shown there, then, by your spectrograms, Nos. 9, 10, and 11, are a number of layers which you superimposed, for instance, on No. 1, don't you?

A. Well, a few of them, yes; might come near to No. 1, but the pattern does not superimpose No. 1.

Q. As a whole?

A. As a whole, yes.

Q. Dr. Clark, will you be good enough now to turn to pattern 149? Do you have that before you?

A. Yes.

Q. Tell me what is the maximum amount of oxidation as you understand that pattern that comes within its scope?

A. This is a process for preparing a material high in lead content.

Q. Will you read my question, please Mr. Stenographer?

(The question was repeated by the reporter as follows:

"Q. Tell me what is the maximum amount of oxidation as you understand that pattern that comes within its scope?")

By Mr. Morris:

Q. Disregard the Claims if you want to, but tell me in your answer if you have disregarded the claims. Let's take the disclosure and operate the disclosure within the limits of that disclosure and tell me what is the maximum amount of oxidation that one may get?

A. I don't think it would be possible to determine it or to say what the maximum amount of oxidation is. No temperature is specified here.

Q. Then the operator is free to use whatever temperature he pleases, isn't he, short of ignition?

A. No temperature specified. Of course, the temperature is conditioned, certainly, in part by an air pressure which is specified of 2.5 pounds per square inch passed into this drum while being rotated.

Q. Will you read me the answer, please?

(The question was repeated by the reporter, as follows:

"A. No temperature specified. Of course, the temperature is conditioned, certainly—")

By Mr. Morris:

Q. All right; how is it conditioned by that; explain it; how is it conditioned by that?

A. The condition is one of the various rates.

Q. How?

A. The rate of the air and the condition of the temperature.

Q. It does?

A. It does.

Q. Will you reflect a moment on that and tell me whether you are right?

A. Of course, I am assuming from this an air pressure apprehends a blast or a current of air with a differential of 2.5 pounds per square inch passing as a current through the mill.

Q. Very well. What is your volume of air that passes through the mill under that pressure? Does your volume have anything to do with temperature?

A. You mean the total volume of air within the mill?

Q. Whether the volume of air that passes through the mill affects the temperature by making it higher or lower?

A. The volume is not the effective matter; it is the rate at which the air current moves.

Q. All right. Is there any limitation upon size of the opening in the outlets of that pipe in 149? Not in the drawing, please, but in the patent?

A. Within this cylinder is fitted an air blower provided with small holes.

Q. Then the limit upon that dimension is what?

A. Small holes.

Q. Yes; they might be pin points or needle points?

A. Might be, but, of course, such a process we know would be commercially non-feasible.

Q. The operator of that process would be at liberty to obtain through that mill such volume of air at 2.5 pressure as he desired?

A. He would determine that by the size of his holes.

Q. But he could fix the size of his holes so far as this patent goes?

A. Yes.

Q. So that he can get any temperature he pleased, couldn't he?

A. Well, he would have to take into consideration, of course, radiation, size of the lead, size of balls, the auxiliary cooling apparatus, and things of that sort.

Q. He doesn't have to do that in patent 150, does he?

A. There is not a statement, it seems to me, in 150, that there is cooling provided.

Q. No, on the contrary, an insulating covering is provided, isn't there?

A. Provided around the rotating cylinder heat insulating apparatus to prevent the radiation thereof, yes.

Q. Does that tell you what your limit of temperature is in 149 at either top or bottom?

A. No specific values, of course, are given.

Q. The operator would be at liberty to operate that at any temperature he pleased provided he obeyed the intention in lines 91 to 96 in patent 149 which says: "It easily oxidizes, and spontaneously ignites, so that it is necessary to provide with a cooling apparatus to radiate the heat generated by friction when treating easily oxidizible metals, such as lead". Would not the

operator then be at liberty to use such temperatures as he desired for the particular operation in hand?

A. It is a very decided upper limit to what temperature he could use, that is, the point of suitering of the mass, the melting point of lead.

Q. That is 327 C., or thereabouts, isn't it?

A. It is.

Q. So he couldn't go above that?

A. You would have a solid mass.

Q. Of course, he would. So that his upper limit is the fusing point of the metal; is that right?

A. Unquestionably. At temperatures below 327 there is a centering effect.

Q. About what, Dr. Clark?

A. I couldn't give you an exact figure, but I would say fifty degrees below that?

Q. F. or C.?

A. Centigrade.

Q. So that would be ninety below 612, 612 being the equivalent, as I recall it—612 F. being, as I recall it, the equivalent of 327 C. 90 from 612 leaves you 522, so that he would at liberty to operate in any range under the disclosure of patent 149 that was below 512 F; am I right?

A. By no means would I put such accurate figures; I would simply estimate them.

Q. Ordinarily is that true?

A. I should think so, yes.

Q. Now, what is the low temperature?

A. 60 degrees centigrade.

Q. Isn't it rather peculiar, then, Dr. Clark, that where Mr. Shimadzu designed a low temperature in the use of the same process he asked for an insulating jacket to be put around his mill in 150, and when he wanted cooling, he could operate not a two hundred or three hundred and ninety-two F., but he put a cooling jacket to keep it down below 512, and he wanted a heat-

ing apparatus on his other mill of the same size, dimensions, and carrying through the same process to get it up to 200 C; can you reconcile the statements of the inventor with the test which you have just given?

A. Well, it would seem to me that the inventor was trying to include in his statement a range of temperatures. I think any of us would admit that a commercial process of sixty degrees centigrade would be entirely infeasible and would not work on a commercial scale and make a desirable commercial product. His intention, it seems to me, if I can read it rightly, is simply to inclose within a certain range of temperatures the possibility of reaction.

Q. What percentage of Pb_2O did you find in the product, theoretically or actually, of patent 149? Any?

A. I don't know that I have ever had a sample of 149.

Q. What is the greatest percentage of Pb_2O that you have found and been able to isolate in any product with such material as this?

A. Any mill product, you mean, or any product whatsoever?

Q. Any, whatsoever?

A. 30 per cent in a dissociate of lead oxide.

Q. Dr. Shimadzu didn't know very much about what he was disclosing in patent 150, did he, Dr. Clark?

A. He was using the art and the literature of the time as best he could.

Q. Oh, then, if I understand you, what Dr. Shimadzu was disclosing in patent 150 was not his invention but what he read in the literature of the prior art?

A. Not at all.

Q. Will you get me straightened on that, please?

A. It was simply the fact that in the literature from the time of Berzelius on, fifteen or twenty authorities, chemical authorities, of one nationality and an-

other, Berzelius and others, described a velvety black product of extreme activity just as we have indicated a while ago the chemical analysis. Berzelius was wrong when he said he had prepared a sample of lead suboxide, but the other has a pure substance and associated with a certain kind of material with certain properties—

Q. To wit?

A. Intense activity, a black color, a spontaneous burning, and so on; was well established, and when such a product was obtained in experiments, Mr. Shimadzu, I think it was only natural that he would assume upon the basis of what was then known that he was preparing by a different method a material which seemed to correspond in its properties with the suboxide of Berzelius and others.

Q. Did it correspond with Berzelius's, regardless of whether the proper chemical nomenclature or name for it is suboxide?

A. What Berzelius was preparing we now know by a repetition of his same experiments and by use of the X-ray method was phyrophoric lead in large excess.

Q. And what else?

A. Lead oxide.

Q. Consisting of what?

A. PbO, and, possibly, of course, as we know under heat conditions of 310 degrees centigrade, of actual lead suboxide.

Q. I am sorry, I missed the 310 degrees.

A. That is the best temperature we have found to give a determination of suboxide.

Q. Then, as I understand it, Dr. Clark, Shimadzu in not only patent 149, but including the paint patent and machine patent got what Berzelius got?

A. We make reference to the final product which

finally comes out of the mill. He did not prepare pure lead oxide any more than Berzelius did.

Mr. Morris: Will you read my question, Mr. Stenographer?

(The question was repeated by the reporter as follows:

"Q. Then, as I understand it, Dr. Clark, Shimadzu in not only patent 149, but including the paint patent and machine patent got what Berzelius got?")

By Mr. Morris:

Q. If that question is not clear, may I try to make it a little clearer? Do you make any distinction between the Berzelius product and Shimadzu's product?

A. I don't think I did.

Q. Then Shimadzu attempted to patent a chemical process, did he not?

A. He did patent a new chemical process.

Q. I am sorry. I will deal with that in a moment, but I meant a chemical principle, not a process?

A. The method of making the dissociation of lead oxide is a decidedly different process completely from the oxidation of metallic lead.

Q. Undoubtedly, but my question is founded on your previous answer, Doctor. I don't want there to be any misunderstanding between us: if my questions are not clear, I want you to ask me. My last one wasn't clear. I realize that now. I was dealing with the Shimadzu product. Perhaps my question didn't disclose that. Let's deal now with the product as separate and distinct from the process, because Shimadzu does have patent 150, Claims 14 to 17, or something like that, a product. As I understand you, there is no substantial difference between Shimadzu's product and Berzelius's product?

THE COURT: Now, then. I don't know: I am more or less at a loss on this, but as I understand it, are you talking about the thing that Berzelius said he got, or the thing he actually got; they were two quite different things?

THE WITNESS: Indeed, they were.

THE COURT: Do you mean what he actually got, or what he said he got?

MR. MORRIS: What he actually got.

BY THE COURT:

Q. The thing Berzelius actually got, is that properly described by any of these product claims of 150?

A. No. While Berzelius must have had a combination of metallic lead as we know it now, very finely divided metallic lead, and lead oxide, and lead suboxide, yet we must remember this decomposition took place in vacuum. Let us take two molecules of lead oxide; that would decompose into Pb plus PbO, plus carbon dioxide, plus carbon monoxide. Of course the carbon monoxide is removed and there is no danger of further reduction of lead oxide which is formed to metallic lead. In a reducing one, the whole process is entirely different from an oxodizing one, you produce by the dissociation of lead and lead oxide into lead suboxide, the amount of lead suboxide and of lead and of lead oxide being solely determined by this chemical composition: that is, if we take those molecules of lead suboxide in vacuum, Pb plus PbO, which, together, gives Pb_2O, plus carbon dioxide, plus carbon monoxide. That process is absolutely limited in vacuum to that type of reaction. When, however, that product is brought out into the air, then the very finely divided lead—you can duplicate any mill oxide you want to, practically speaking, by bringing out this vacuum material into an oxidizing atmosphere.

By Mr. Morris:

Q. As I understood you a moment ago, you told me that Berzelius had a mixture of lead, lead oxide and some Pb_2O?

A. Yes.

Q. And now you tell me that Shimadzu has under his 150 and his 151, and his 149 and his 020 patents, some lead fine lead, as in Berzelius', some PbO and some Pb_2O: am I right?

A. Yes.

Q. Wherein is there any substantial difference, then, between the Shimadzu product and the Berzelius product?

A. Which is as I have indicated, that the Berzelius product is limited precisely to one ratio of lead to lead oxide.

Q. That being?

A. One to one.

Q. Are your figures exactly right, Dr.?

A. We can write this equasion here: that is, by one to one I mean—

Q. Oh, my mistake: I was dealing in percentages instead of ratios. I understand you now. So that Berzelius had lead oxide and lead in a ratio of one to one?

A. Exactly.

Q. Where did Berzelius's Pb_2O come in, then?

A. Berzelius assumed, of course, that all of his product was Pb_2O.

Q. And he was wrong?

A. And he was wrong.

Q. Where does Shimadzu's product act differently from Berzelius's product?

A. Shimadzu's product containing finely divided lead plus PbO, plus lead suboxide, in the presence of an oxidizing atmosphere you can get, as you can read-

ily see, I think, a very wide range of distribution between these three components. As a matter of fact, you could get by the primary process a large proportion of lead suboxide or a large portion of lead, or one to one ratio.

By THE COURT:

Q. Didn't Berzelius have any lead suboxide in his product?

A. Duplicating his experiments, we can find some. Of course, he said it is all lead suboxide because he had no way—that is, the chemical analysis, and any observations he made were such as to lead him to believe he had something different—

Q. I understand that he didn't get what he thought he had. But you say he had lead and lead oxide in one to one. It may be lead suboxide in what figure there?

A. We might get as high as—

Q. One-twentieth?

A. 20 or 30 per cent. Every bit of lead suboxide which dissociates still gives us one to one.

Q. I understand that. How long would it take to dissociate: how long would he hold that product consisting of three things? I can't get anything out of it except your testimony there were three things in Berzelius's product, and they were separate things. They were all mixed up together, but three, actually three different things, lead, lead oxide and lead suboxide. When I read claim 15 I see that is a powder comprising a major portion of lead suboxide: 15 says a large portion of lead suboxide: 16 says a large portion of lead suboxide. Now, Berzelius had a powder with a large proportion of lead suboxide in it?

A. Yes.

Q. Or may have had?

A. May have had, yes.

Q. Was his product capable of spontaneous oxidation?

A. It was.

Q. Was it capable of spontaneous reaction and contact with moisture?

A. Berzelius discloses those experiments.

Q. Capable of spontaneous reaction on contact with air?

A. Yes.

Q. A highly chemically active powder?

A. Yes, it was.

Q. Isn't it perfectly described by those three claims?

A. As far as the actual constituents present, both the mill and Berzelius by entirely different processes could obtain mixtures of those three.

Q. That is all right; we are only talking about the product claims now. I realize you can reach identically well known products by a new process, a patent process. That is all right, but I can't see from your testimony where, if we know that Berzelius had what you say he had, if that is a fact; where it is not described perfectly by those three product claims, and, therefore, anticipates them.

Mr. Morris: I feel, if your Honor please, I am imposing on good nature.

The Court: I don't care; I can stay until six o'clock if you want.

Mr. Morris: I think that would be impossible; I suspend now, if you desire.

(Adjourned until Friday, September 27, 1935, at ten o'clock A. M., Daylight Saving Time.)

THIRD DAY.

PLAINTIFF'S EVIDENCE (Continued)

GEORGE L. CLARK, recalled.

Cross-examination (Continued).

By MR. MORRIS:

Q. I forget, Dr. Clark, the exhibit number that was given to the sample of the Pb_2O, so-called, produced by you yesterday. Do you recall what the exhibit number was?

A. The sample itself, you mean?

Q. Sample itself, of the isolated Pb_2O.

A. There is no—no sample was submitted.

Q. Well, then, will you be good enough to let me have a sample of the material that you isolated, which you designated yesterday as Pb_2O?

A. As soon as we got enough to present we shall do so, as the centrifuge experiments continue. The first lot was used up in these experiments, or practically all used up.

Q. I see. You got Dr. Wilson's sample in 1934?

A. Yes.

Q. Had them ever since?

A. We have.

Q. And with this stuff that Shimadzu said in his patent 150 he could produce, in effect, said, in effect, that he could produce ton after ton, you, a scientist and expert, have not been able to produce enough to produce even a teaspoonful here as an exhibit?

A. We can produce a teaspoonful. This supercentrifuge experiment is a long, very long, tedious experiment, in which a small amount of material is suspended.

Q. Why didn't you make it in the Shimadzu mill?

THE COURT: Will you pardon me just a minute?

(Interruption.)

THE COURT: All right, Judge, go ahead.

MR. MORRIS: Will the stenographer please repeat the question?

(The question was repeated by the Reporter, as follows:

"Q. Why didn't you make it in the Shimadzu mill?")

A. This experiment was not for the purpose of making lead suboxide, it was for the purpose of separating the constituents in a powder made by the Shimadzu mill, or made by an Exide mill, or made in these other experiments. That was the sole purpose of that experiment.

By MR. MORRIS:

Q. Well, if Shimadzu could make 93 to 97 per cent Pb_2O, and 3 to 7 per cent lead, the science of chemistry would teach you how to isolate and separate the lead from that Pb_2O, wouldn't it?

A. Yes.

Q. Well, then, there should be no difficulty at all in bringing a tankful of what is left, should there?

A. It is impossible to get out of the mill—there may be ninety-three per cent of suboxide in the mill at certain stages, or the process may have gone through ninety-three, or ninety per cent of the suboxide stage, but at elevated temperatures, under the conditions of operation of the mill, you can't get out a sample that has that much suboxide in it.

Q. Yes, but I am interested in Shimadzu's product. Does he tell you in patent 150 that what he is talking about is that he gets ninety-three to ninety-seven per cent in the mill?

A. In the mill, yes.

Q. He does? Have you a copy of the patent?

A. Yes.

Q. All right, let's turn to patent 150 and point out to me where it says that he gets ninety-three to ninety-seven per cent in the mill.

MR. MORRIS: Has your Honor a copy?

THE COURT: Yes, sir.

MR. MORRIS: What I am talking about is column one, patent 150, lines 50 to 54, or any other place that Dr. Clark may point out.

A. It says that the product of this invention, the composition of powder is approximately ninety-three to ninety-seven per cent lead suboxide. That does not, it seems to me, designate that the product—where the product necessarily is, whether it is outside of the mill or inside of the mill.

By MR. MORRIS:

Q. Oh, what he is patenting here, as you understand the patent, is not something that could be used commercially, not something that could be obtained, but he is disclosing to us that he has found the chemical reactions that take place in the mill when litharge is being made by a mill, is that right?

A. There is certainly not ninety-three per cent of suboxide in the final product borne out in the current of air, and yet we maintain, that is, the mechanism is such that on the interior of the mill, in the process of production of the powder initially, that it may contain—

Q. Dr. Clark,—

A. —such amount.

Q. —my question is for you to be good enough to point out to me anything in patents 149, 150, 151, 152, or 020, or 479 that says one single word about the composition of the product in the mill.

A. There is—there is—no statement is made about the composition of the product in the mill or out of the mill.

Q. You testified here yesterday as a patent expert explaining to us your understanding, your grasp of the patents in suit. Is it your understanding that the product of a patent, which product is covered by claims of the patent, means something that is so fugitive, a chemical reaction in the mill, that not a spoonful of that product can be isolated or found in the ultimate product covered by those claims.

A. Why, I understood what you say, but just the question which you want me to answer I don't believe I understand.

Q. Well, then, we will try again, please. Dr. Clark, you testified yesterday as a patent expert. Am I right so far?

A. I testified as an experimental chemist.

Q. Well, you explained the patents to us, didn't you?

A. I read the patents, but I—I make no claim of, legal claim of being able to put any legal interpretation upon the words of this patent or these patents. I am an experimental chemist.

Q. Oh, you want to withdraw your qualification now as a patent expert?

A. I don't withdraw my qualification as a—

Q. Well, then, let's go back to our primary question. As a patent expert, and one who understands the patents in suit, is it now your testimony that what Mr. Shimadzu covered by his product claims in suit

was the product that appeared, at least theoretically, in your opinion, during the process of the making of the product covered by his claims, and was not to be found in, or did constitute a major portion of the ultimate product of 150?

A. Well, there is only, there is only, certainly, one answer to that question, and that is this (when the statement is made of a composition of powder containing ninety-three to ninety-seven per cent lead suboxide, that can refer only to an intermediate product, not the final product).

By THE COURT:

Q. And do you think that applies to the claims 15, 16 and 17, the product claims of the patent, also? For instance, the final product, as I understand it, does not contain a major portion of lead suboxide. Is that your understanding, or am I right about that?

A. The final product—it just depends upon our interpretation of "major", of course. The final product, if we think of "major" as being fifty-one per cent, it does not contain it.

Q. Yes, well, do you think the final product contains a large portion of lead suboxide, the final, commercial product that he makes?

A. It does not.

Q. Well, of course, then, you are correct in saying there was only one answer to Judge Morris' question, and you have answered it that the product claims cover a product which is an intermediate product,—

A. Yes.

Q. —but which disappears as an entity, as a product, when the process is completed?

A. That is right.

THE COURT: All right, now, that is very clear.

By Mr. Morris:

Q. May there not be another answer to my last question?

A. Why, I don't—I don't think of any, just at the moment.

Q. You told me yesterday that the renowned Berzelius didn't have what he thought he had. I wonder if you are placing Mr. Shimadzu, attributing to him a greater ability in that line than you do to Mr. Berzelius?

A. Certainly not.

Q. Then there is another answer to my previous question?

A. Yes, I am glad you have mentioned that.

Q. And that answer is what?

A. That Mr. Shimadzu in speaking of ninety-three per cent, or whatever it is, might easily have been thinking of an exceedingly intimate mixture, variable mixture of lead and lead oxide. He was using, when he used the word lead suboxide, was using—that is, taking that large quantity—was using the literature or the chemical state of knowledge of his time.

Q. In deed, I don't understand that answer. Do you mean to tell me, Dr. Clark, that Mr. Shimadzu was calculating in his product as Pb_2O—PbO, and converting that theoretically into Pb_2O, and then telling us that he had gotten this product to that extent?

A. No, not at all.

Q. Then I misunderstood you.

A. Yes.

Q. Won't you tell me, please, Dr. Clark?

A. Shimadzu felt that, reading the experiments of—in the literature from the time of Berelius on down through all these books, read of the discovering of the properties of a substance which he called lead

suboxide, or which was called Pb_2O, and in the initial experiments in Japan there were certainly produced—

Q. What is that?

A. In the experiments in Japan—

Q. Oh, you were there? You are testifying as an expert—

A. No.

Q. —from what knowledge?

A. From the examination of oxide samples from Japan.

Q. Produced when?

A. Well, over the last several years. Of course, I didn't know anything about the original experiments, never seen any specimen at all.

Q. I wonder if it wouldn't be well for us to speak about the samples of which you have knowledge, and not speak of what was originally produced in Japan.

A. Yes, I never have seen those.

Q. All right, then if you will be good enough to confine your testimony to those things you know, or about which you are speaking as an expert from facts which you know, you may be guilty of less inaccuracy.

A. Well, to reduce the thing to a nutshell, the situation is this, Shimadzu thought, based upon the literature, that he was making lead suboxide, and we feel in accordance with the mechanism, the study of the production of Shimadzu's mill, that lead suboxide was and is being produced, not in a pure form, but in an intermediate stage, ninety per cent or more of the final product or the actual production of the material has gone through a lead suboxide stage, and has then undergone dissociation into lead and lead oxide.

Q. Now, then, you as an expert are interpreting these patents to cover, then, the reaction which takes place in the formation of any lead oxide, is that true?

A. Yes, that is just as we have stated before, that

there may be formed in an intermediate stage lead suboxide, because we know that and contend that lead suboxide does exist as a very fugitive compound, which dissociates under the proper conditions and is no longer present in such amounts in any final product.

Q. So what Mr. Shimadzu is attempting to do, as you construe his patent, was to monopolize that reaction which takes place in the mill, if it does, and not, and did not disclose to us, either a product of the character of that described by him, or the process of utilizing, or disclose to us a chemical process that would have utility in producing and giving us the product of that process, is that right?

A. Well, according to my understanding, I don't see that there is precluded the possibility of taking any product which is formed as an intermediate stage, or even as a final product, and changing that or allowing it to change subsequently so that it can meet any specific needs of a commercial product for a commercial use that might be needed.

Q. Is it your thought, Dr. Clark, that all oxides of lead, the higher oxides of lead, have to pass through, first, through the reaction of Pb_2O, or that the first oxidation of lead is in all cases Pb_2O, and then that it proceeds from that to the higher oxide.

A. Well, if we take a solid gaseous system, solid lead, and submit to that or bring together with that an oxidizing agent it seems to me that as a transient, initial stage, following the absorption upon the surface of the gaseous film, that it is a perfectly logical thing, now, you can take a piece of ordinary lead and let it simply stand in the air, all by itself, just as Berzelius, the very first experiments that Berzelius himself did, forming a dull skin on that lead. What is that, the question is, what is formed there, even at ordinary low temperatures? It is possible to find evidence of

lead suboxide in a film like that, mixed, of course, with basic carbonates and other things of that kind.

Now, I feel it is a perfectly logical thing, in accordance with the models which I explained yesterday, that when you bring metallic lead and a gaseous oxidizing agent together that as a first step, it is the most logical thing that we could picture, and does not mean to say that all oxides of lead, by all methods whatsoever, necessarily have to pass through any suboxide stage.

Q. Let us make litharge by a process that does not have to pass through that step. What would that process be?

A. I do not think that lead suboxide necessarily needs to be formed with molten lead.

Q. But any oxidation of even the shot which I carry in my charged shells when I go hunting has lead suboxide on it, according to your theory?

A. If those shot become covered with a—with a dull coating, and by exposure to air, especially in the presence of moisture, it is entirely possible, in fact, I think it is entirely—it is true, very probably, that suboxide has at one stage or other existed in a very transient stage, when oxygen has first entered the superficial layer of lead atoms. Of course, as I say, the cover of that shot will also have basic carbonates and other constituents of that kind, basic sulphates, and so on, in ordinary air.

Q. So, as we understand each other, then, I take it that what Mr. Shimadzu patented in 150 is what went on in the mill, and not the product that came out?

A. Yes, that is right.

Q. Dr. Clark, won't you tell me what the minimum temperature is for operation of 149?

A. Temperature isn't specified in 149, as we found yesterday.

Q. Well, as a man skilled in the art, how long

would you operate it, could you operate it, and be within the patent

A. Well, certainly the temperature would have to be such as to produce a product. That might be a very low temperature, as we have found, possibly, at sixty degrees centigrade, some product is formed, though not—that is, the process is certainly not efficient in the sense of producing large quantities of commercial material at sixty degrees. I would say that the lower limit would, therefore, be that temperature where a product could be formed of the finely divided powder.

Q. So you are not quite in accord with Mr. Ishimura, then, when he says the product that is formed at 150 degrees F. is the same or substantially the same as that formed at 112 F.?

A. I beg your pardon, may I have that?

Q. Yes. I understood Mr. Ishimura to tell me under cross-examination that there was no difference between the product formed in the Shimadzu mill at 112 degrees Fahrenheit and the product which would be formed at 125, or 135, 146, 150, etcetera.

Mr. Schaffer: What page of the record is that on, Mr. Counsel?

Mr. Morris: I don't know, Mr. Schaffer.

By Mr. Morris:

Q. Did you so understand him?

A. I think, if I remember rightly, he said that the distribution of constituents within the powder is, of course, a function—or some words to that effect—is a function of the temperature. Of course, that is true.

Q. Well, I am glad to know that, but I didn't so understand it. Well, without taking the time to refer to the record as to what he did say about 112—suppose we do take that time.

Mr. Morris: Will you find me what Ishimura said about the 112 degrees, and 125 and 150 F.?

The Court: Page 128, he says:

"Q. Suppose—do you get any different product at 112 degrees Fahrenheit from 125 Fahrenheit?

"A. Well, it wouldn't be very much difference, as the temperature range is so close.

"Q. Would you get any different product at 125 Fahrenheit and 150 Fahrenheit?

"A. Pardon me, 100 and 150?

"Q. Between 125 Fahrenheit and 150 Fahrenheit.

"A. Well, I don't see exactly how much, but there will be some difference, little difference.

"Q. Difference in degree or a difference in character?

"A. Difference in oxidation.

"Q. Well, wouldn't there be the same difference between 125 and 150 Fahrenheit that you would get between 150 and 175?

"A. A slight change, anyway.

"Q. What?

"A. Little change.

"Q. It would be a change? Would it be one of character?

"A. As the temperature rises, according to temperature rises the products change accordingly.

"Q. Well, suppose you operate at room temperature, would it be the same in character?

"A. No, if you operate at room temperature your product would contain mostly metallic lead. That is what I think."

By Mr. Morris:

Q. Do you agree with Mr. Ishimura as his testimony has been read?

A. Well, if we understand by the change in the product simply a—because of the varying temperature

coefficients of all these things that are involved, a different distribution in the product, different relative amounts of the constituents of the powder, I think there is no question, but even at the lowest temperatures you would have a lead and a lead oxide, PbQ, and lead suboxide.

Q. That is, if you introduced air in your mill?

A. Yes. Of course, that doesn't take into consideration at all the efficiency of the product, or the production of the commercial material.

Q. No.

A. It is just a purely laboratory experiment type of thing.

Q. So that to get into any utility, substantial utility for commercial purposes it would have to be at least sixty degrees centigrade?

A. It would have to be higher than that. That is just a lower possible range.

Q. And then would run on up to—

A. Two hundred degrees centigrade.

Q. Two hundred degrees centigrade. You are speaking about 149. I take it, aren't you, patent 149?

A. Yes, yes.

Q. Dr. Clark, won't you be good enough to look at this drawing over here? As I understood you in one of your answers a moment ago you spoke of the necessity of blowing the material out of the mill. Now, I may have misunderstood you, but that is the way I did understand you. Was my understanding correct?

A. The necessity of blowing it out of the mill? No, I didn't intend to make any such statement as that.

Q. Then it is not necessary, then, to blow it out of the mill?

A. It is convenient.

Q. But not necessary?

A. Not necessary for the—for the continuation—or, for a chemical reaction to take place within the drum.

Q. That is, if the first step in oxidation of lead is Pb_2O, that first step will take place in the mill regardless of the length of time that you permit the powder to remain in the mill thereafter?

A. Of course, the longer the time—that is true—the longer the time at those elevated temperatures certainly the less probability of the existence of any lead suboxide at all in the product which is finally taken out.

Q. With that we are not particularly interested, are we.—

A. No.

Q. —the final product? Your answer to that is "no"?

A. No; not right now.

Q. Are we or are we not particularly interested in the product that comes out of the mill?

A. Well, I think in many respects we are very much interested in the product which finally comes out of the mill.

Q. Well, I thought we were interested only in the reactions which take place in the mill?

A. Well, those are—

Q. Am I right or wrong?

A. —two separate considerations, of course.

Q. Well, do you understand patent 150 to tell us how to get Pb_2O in the mill, or what is it?

A. Exactly, it is to produce a reactive powder in the mill containing a large proportion of lead suboxide.

Q. I see, and not a process for making a product that—the product that comes out of the mill?

A. Well, I think it is—I think it is, you have to get the product out to use it, and it seems to me that the

process also involves a convenient method of removing the product from the interior of the mill which has been formed by certain chemical reactions, clear outside of the mill.

Q. Would the Pb_2O, so-called, that forms under your theory in the mill the increased in amount or decreased in amount in accordance with any temperature curve?

A. We positively know that the dissociation of lead suboxide is very sensitive to temperature. I may illustrate that—

Q. No, now, Doctor,—

A. Yes.

Q. —I asked you about the formation and not the dissociation.

A. The formation proceeds, the formation of lead suboxide proceeds just exactly—the rate may change—the lead suboxide formation at an elevated temperature may take place in just the same mechanism.

Q. I am afraid we are still at just a little cross purposes, either I don't understand it, or I haven't made myself clear. May I try again?

A. Yes.

Q. I am wondering whether the probabilities of the formation, the probabilities of the reaction of Pb plus PbP, forming into Pb_2O, according to your theory is expedited by any increase or decrease in temperature from room temperature.

A. It is, the rate of formation is expedited by an increase of temperature, up to an optimum.

Q. Then it is expedited or accelerated by increase of temperature, the other conditions remaining constant?

A. Up to an optimum temperature.

Q. Where would you fix that optimum?

A. Well, it is, let us say, in the—certainly below, somewhat below three hundred degrees centigrade.

Q. Well, the three hundred degrees centigrade is pretty close to the fusing point, isn't it, which is 327?

A. You mean of lead, yes, that is true, but I am speaking of the rate of reaction of Pb_2O, itself.

Q. Well,—

A. Perhaps I ought to—

Q. No, I am sorry if I interrupted you.

A. Yes, there are no experimental data bearing, no data at all bearing upon the rate of formation of Pb_2O as a function of temperature in such a mill as this. We do have data on the formation of Pb_2O from lead oxalate, laboratory experiments of that sort.

Q. I wasn't going to ask you for your data on that, at least, I had no thought of it at the moment, but as an expert and a scientist, other conditions remaining the same, other factors remaining the same, and conditions the same, you would expect, would you not, the reaction which we have spoken of as the Pb_2O reaction in the mill to be accelerated by increased heat, up to approximately three hundred degrees centigrade?

A. Yes, that is probably too high, too high a temperature, that is—that is merely a very rough—

Q. Oh, well,—

A. —higher limit.

Q. Well, of that order. What difference do you find in the process disclosed in 149, patent 149, and patent 150 and patent 151?

A. What difference in the process?

Q. In the process, yes.

A. No essential difference in the process.

Q. Not—

A. Outside of the point of cooling and heating which we spoke of yesterday.

Q. Well, which I didn't understand, and we will come back to that in a moment,—

A. Yes.

Q. —so that you will help me out on that, but the processes of those three patents are the same, indeed; the claims of process claims of 150 and 151 come within the scope of claims 1 and 2, one or two, one and or two of 149, as you interpret those claims, Dr. Clark. Let me read to you, for instance, claim—I will tell you which one it is—of 150,—

A. All right.

Q. —and you can take either claim—take claim two of 149, and let me read you claim one of 150:

> "A process of manufacturing a fine powder of lead suboxide intermingled with powder of metallic lead, comprising in putting pieces of metallic lead in a rotatable vessel in a dry state, introducing into the said vessel currents of an oxidizing gas to oxidize the surface of the lead while rotating the said vessel, and abrading off the oxide formed on the surface."

If I should do that would I be infringing claim two of patent 149, according to your—as you interpret it?

A. Well, as I interpret, there is very slight difference, claim two of 149 purports to form a material containing a higher proportion of lead, metallic lead.

Q. Where do you get that, Dr. Clark?

A. Well, in claim two it simply says "A method of forming a finely divided chemically reactive lead powder."

Q. But I thought we were under the impression, I was under the impression—withdrawn—I gathered yesterday from what you told me that it is not possible to obtain lead powder by rumbling lead balls, and consequently that—in an inert gas—

A. Yes.

Q. —and that consequently when it was done in a current of air we got a lead oxide?

A. Yes.

Q. Now, then, we have gone over 149, and we find that it is operating at the same temperature, 60 C., as a minimum, with at least up to 200 C. Now, then, I am wondering just exactly how you get the metallic lead powder out of 149.

A. Well, the process can certainly be conducted within a range, of course, that is, in any of these, the whole process itself, as regards temperature, and the amount of air, and the cooling produced by the air, and things of that sort, so that a varied product can be obtained. A pure lead powder cannot be obtained.

By THE COURT:

Q. May ask a question to straighten me out? When you speak of lead powder you apparently, as a scientist, mean pure lead powder, or do you? In other words, to me, as a layman, when I speak of a lead powder I would include various degrees of oxides of lead powder. Now, is that right or wrong? In other words, if this powder here contains eighty per cent of lead and twenty per cent of lead oxide I would be inclined to call it a lead powder. Would I be right or wrong?

A. I think you would be right, that is, we can buy, in the chemistry laboratory, we can buy materials on the market, lead, metallic lead, which may have varying amounts of impurities present in it, in that, and still call that lead powder.

Q. You see, it makes a difference in interpreting these claims;—

A. Yes, sir.

Q. —because if a chemically reactive lead powder means pure lead powder, that is one thing,—

A. Yes.

Q. —but if it means a powder having a certain amount of lead oxide mixed up with it, then it might

mean simply the same product as 150, with a higher amount of lead in it.

A. That is the way—

Q. I don't know.

A. That is the way I interpret it.

Q. It depends on what the words lead powder mean.

A. Exactly.

Q. You see, after all, I don't have these test tubes and centrifuges, I have got to deal with words,—

A. Yes.

Q. —and it is a question of whether these words here on paper cover certain products or whether they do not, and it is a question of definition. Now, it is important, I should think, in this patent to know what the words "lead powder" mean.

A. Yes.

Q. It seems like a simple thing, but when you get down to it it may not be so simple.

MR. MORRIS: That is the reason I have been trying to inquire what are the differences in the disclosures of the two patents, and the differences in the limitations and restrictions of the two, to see whether the are not foursquare.

THE COURT: Well, he may be right, if lead powder simply means the same thing as 150, except having a higher degree of lead in it, and less lead oxide, I don't know. I mean, that is just a thought that comes to me.

MR. MORRIS: There is the difficulty I find with either interpretation, I don't care what interpretation he gives it, the difficulty I am finding is this, that the limitations of the two patents with respect to disclosure are exactly the same, that is, you begin in each at sixty degrees, the witness tells us,—

THE COURT: Oh, with regard to the specification.

MR. MORRIS: Yes, sir.

THE COURT: I am only speaking of the claims.

MR. MORRIS: Yes, but I assume that if we begin at the same point and end at the same point, and use the same steps, that is one thing. Now, I don't know whether the witness is interpreting—

THE COURT: Well, provided the steps are all absolutely narrow and defined that you can't do it any different way, but suppose by blowing a little more air on you get more oxide in the final product, there might be some excuse for two different patents, I don't know.

MR. MORRIS: I don't know.

By MR. MORRIS:

Q. Do you find any excuse in patent 150 for blowing any more air in than you do in 149?

THE COURT: Well, I said blowing air, I don't know, controlling temperature, I don't know what, but it just might be that instead of patenting one process they made—well, I will no doubt be enlightened on this later on.

MR. MORRIS: Well, I am trying to get some enlightenment myself.

THE COURT: All right.

By MR. MORRIS:

Q. Do you mind answering the question which I just—well, I will withdraw that question and put it this way: do you find anything in patent 150 that tells the man who is studying it and studying 149, too, that

he must use more air in 150 than in 149, or does it appear that he must use more in 149 than in 150?

THE COURT: They call it blasts of air in 150. I don't know whether they use that expression in 149, or not.

MR. MORRIS: 149 says 2.5.

THE COURT: 2.5 pressure.

MR. MORRIS: That is right, but it doesn't say anything about volume.

THE COURT: "sent out of the air-blower"; now, 150 talks somewhere—

MR. MORRIS: You see, in 65, 66, 67 on page 1 it says, "while air blast—

THE COURT: Yes.

MR. MORRIS: In 149—"having a pressure of 2.5 pounds per square inch, is sent out of the air-blower." so we get blasts,—

THE COURT: Yes, you do.

MR. MORRIS: —and a 2.5 pound pressure. As I read it, Dr. Clark, you get the air blasts where no pressure is given, in 150, I think it uses "blast" in 150; "gust", anyhow.

THE COURT: Gust.

MR. WHITCOMB: "Pipes to blow air thereinto", line 96.

THE COURT: Well, I don't even know if that suggestion is worth pursuing, even.

MR. MORRIS: Well, I have been trying to find out what the difference is.

THE COURT: Yes, I don't know, either.

By Mr. Morris:

Q. Can you answer the question now, Mr. Clark, please?

A. Well, I don't know that a final answer can be given. My interpretation is that the 149 patent possibly operating at a somewhat lower temperature, under somewhat different conditions, produces a lead powder, which may mean an impure lead powder, and, of course, in any current of air it will be impure.

Q. Yes, but, as I understand it, Dr. Clark, the man skilled in the art who is operating the process of 149 would get any degree of oxidation in his ultimate product that he desired, from the minimum to the maximum, wouldn't he, the same as he gets in 150?

A. If he varied the temperature, and, of course, had sufficient air present, and a sufficiently high temperature, why, he could vary the product, yes.

Q. But you take him through the same temperature range in 149 as you do in 150, so he would be at liberty to do that, then, wouldn't he?

A. I think so, yes.

Q. Now, Dr. Clark, I am interested in another thing, and I wish you would help me out on that just a little bit. I got the impression from all these patents, 149, 150, 151—well, I will withdraw that, because I think it isn't accurate.

Do you get any instruction in 149 or 150 or 151 to blow the powder out of the mill as soon as it is formed?

A. There is no statement in these patents requiring an instantaneous, if I remember rightly, an instantaneous—the necessity of instantaneous removal. In 150 the words are used, "it is convenient to utilize the force of the current thus caused to blow the powder formed out of the cylinder, and then collect it."

Q. Then you do not find that to be a process, a step

in the process, of the processes disclosed in 149, 150, 151?

A. In answer to that question, in 149, claim two, 149 has the following words: "removing the said powder from said vessel by means of said current of air."

Q. Yes.

A. 150, claim two, is the statement: "causing such blast to blow the powder produced out of the vessel."

Q. You find identity in substance there, do you?

A. Yes.

By THE COURT:

Q. Well, under those two claims, but, then, there are a lot of claims that do not say anything about it. Claim three doesn't say anything about it.

A. That is true.

By MR. MORRIS:

Q. If we may pause at claim two in 150, and come back to your preceding question just a moment later, if you follow the steps of claim two of 149 and claim two of claim 150 you get a time factor, Dr. Clark, that is the same, don't you?

THE COURT: Two of each one?

MR. MORRIS: Two of each.

By MR. MORRIS:

Q. Apparently the powder is intended to be blown out in each at the same time?

A. Yes, you have "removing" in the first case, and "causing" in the second.

Q. The second?

A. Same thing.

Q. Same thing. Now, does a time factor enter into the ultimate product, the other conditions remaining constant? I am not speaking now of this reaction in the mill,—

A. Yes.

Q. I am speaking of the product that comes out in the can.

A. Of course, as the product is maintained at the elevated temperature for a longer period of time oxidation could proceed more completely, that is, we can have a somewhat higher proportion of lead oxide. If the powder is retained over any period of time it is possible for the lead particles which are formed to grow into little balls, metallic balls. The net result of holding the product in the mill at the elevated temperature, that is, instead of removing instantaneously, therefore, is just simply to allow the oxidation to proceed a little bit further, and possibly to cause a grain growth.

Q. So that, the other conditions remaining the same, or constant, the blowing it out at an early stage, or as soon as formed would indicate to you, perhaps, that Mr. Shimadzu meant his ultimate product out of the mill to be higher in Pb_3O_4, so-called, than it would be if it were permitted to remain in the mill for a longer period of time.

A. Well, there is no question about that, and also, metallic lead, you must add that, too, metallic lead would have, some of it, and opportunity to oxidize.

Q. Then if Mr. Shimadzu was interested only in what went on in the mill and not in the product that he got he wouldn't care how soon you got it out or how late you got it out, would he?

A. Well, he would be, of course, he would be interested in the utility or the usefulness of the product, and undoubtedly guide or direct the operation of the mill to that end, to the best end.

Q. Why does the product have utility?

A. It is a product with valuable properties for storage batteries, primarily.

Q. Does the chemical property, whether it is Pb_2O or PbO, make any difference?

A. In the production, that is, in the production of a storage battery plate it makes no difference.

Q. So whether the—it not only makes no difference in the ultimate product, but it makes no difference as to whether your theory that it went through a Pb_2O stage in the mill is correct or not, does it?

A. Well, it makes a decided difference in conditioning grain size. In answering your previous question, of course, I was referring to the fact that any lead suboxide or PbO present when mixed in the paste for making storage battery plates with sulphuric acid, or by other means, of course, are instantly destroyed, and as regards any specific effect upon a plate, outside of the distribution of metallic lead and PbO, and the grain size of PbO, any lead suboxide is destroyed in the paste at the instant that it is made.

Q. Well, now, if I understand you, then, your thought is that the degree of fineness is of some moment?

A. Yes.

Q. And your further thought is, as I understand you, that the degree of fineness had by Shimadzu can be the result only of a reaction in the mill, because according to your theory a product, an ultimate product, of the fineness of that of Shimadzu cannot be had save by chemical reaction?

A. At least a large proportion must have passed through a molecular process, that is, judging by experimental data we have on any grinding, by any known grinding process, of a metal.

Q. I see, so it wouldn't make any difference

whether it is Pb_2O stage that it passes through or any other stage, as far as you know, provided it is the result of a chemical process?

A. Well, that is the important thing, yes.

Q. So whether you call that process—whatever you call it, provided you get fine powder in your ultimate product, that satisfies all the utilitarian requirements, does it not

A. If it would have the same degree of fineness and reactivity I should say that it did.

Q. I wonder, Dr. Clark, just where you got this part, I am referring now to Exhibit 14, Plaintiffs' Exhibit 14, supposed to illustrate patent 150, or the machine that is made obvious and clear from the description. I cannot find in there, Dr. Clark, and I am wondering where you do, the air that blows the lead dust out of the jacket that surrounds the drum after the lead dust has passed from the drum into the surrounding cylinder. Do you find that in the patent anywhere? I don't. Now, if you will, look for it.

A. May I ask, do you mean is there provided a definite piece of machinery for blowing air, or—

Q. No, the phraseology in the patent, as I understand it, is blowing the dust out of the cylinder in the way that we have been talking about. Now, then, we have blown it out, but you have added an extra step here, you have blown it not only out of the cylinder, perhaps, but you have also blown it out of the surrounding jacket, and I do not find any provision in the patent for that. Do you? The one I find is line 13 page 2: "If it is blown into, it is convenient to utilize the force of the current thus caused to blow the powder formed out of the cylinder, and then collect it."

Now the cylinder that I understand him to be talking about there is the cylinder or drum or mill having the charge in it.

A. Well, of course, this cylinder is pierced with these holes.

Q. That is right.

A. And any sufficient blast of air, don't you think the air would pass out through these holes?

Q. Yes, I think so.

A. Particularly as the balls are rotating, forming new, making available a new part of the drum continuously.

Q. But you interpose a draft there sufficient to blow it, the dust, out of the cylinder, out of the surrounding jacket, which I don't understand is called for by the patent.

THE COURT: Well, how about the words "then collect it"? You can't blow it out and let it escape, you have to do something to collect it.

THE WITNESS: Yes.

THE COURT: Of course, it could be collected by gravity, I suppose.

MR. MORRIS: That was what I had in mind. I don't find this step, and I am wondering where you find it.

By MR. MORRIS:

Q. Did you find anything else other than what has just been read to you?

A. No; I think—I think it is just assumed.

Q. Well, would—

A. Just as we have been speaking of, that the air can pass out through these holes, as well as straight through the drum itself.

Q. Oh, that is true.—

A. Yes.

Q. —but suppose you have a stack up here for the air to escape, and suppose we make this bottom a fun-

nel shaped device, and let it just pass out by gravity, then you are not required to give the air this additional function or duty of blowing it out of the bottom of the surrounding jacket, are you?

A. Well, the statement, of course, is made here in 150 that the powder produced, the powder produced—

Q. Yes.

A. —must be blown out of the vessel—blown out of the vessel.

Q. I wonder if you would mind answering my previous question.

A. Yes.

Mr. Morris: Will you read it, please, Mr. Stenographer?

(The question was repeated by the reporter, as follows:

"Q. —but suppose you have a stack up here for the air—")

Mr. Morris: Won't you let me change that?

By Mr. Morris:

Q. Suppose you have a stack at the top of the surrounding jacket, such stack leading upwards, and you have your surrounding casing or jacket funnel-shaped, beneath the rotating drum, so that when the product or dust produced in the rotating mill is discharged therefrom it falls by gravity through the funnel constituting the bottom part of the casing surrounding the rotatable drum. That would work just as well, would it not, as this disclosure?

A. Well, I wonder it—I doubt if it would, to answer it, and then I will say this, would it be possible for such arrangement to so perfectly regulate the air up the stack that you wouldn't have all sorts of tur-

bulent conditions in there, which would seriously interfere with any successful settling or gravity conditions? I think it would.

Q. You think it would interfere with the gravity conditions?

A. Such turbulence would, yes.

Q. I see.

THE COURT: I think that I will recess at this point for ten minutes.

(Recess at 11.13 o'clock A. M.)

AFTER RECESS.

GEORGE L. CLARK, recalled.

Cross-examination (Continued)

By MR. MORRIS:

Q. One or two more questions and we will leave 149 and 150. I wanted to get clear in my own mind as to whether the blowing out of the powder is one of the essential steps in the Shimadzu process, the blowing of the powder out of the rotating mill. You told me at one time, I read what is disclosed in lines 13 to 16 of page 2 of 150: "If it is blown into, it is convenient to utilize the force of the current thus caused to blow the powder formed out of the cylinder, and then collect it."

A. Yes.

Q. As I understand you, it is optional and not mandatory?

A. There is no other means provided in the ap-

paratus as disclosed in the specifications for removing the product except by using the convenient blast of air that is put in.

Q. I wonder if you are right about that, Doctor, because on lines 85, 86, and 87 he provides a cylinder, an iron cylinder pierced all over with holes one-eighth of an inch in diameter at the rate of four holes in one square inch; so gravity is a force, isn't it, that operates in the presence of this mill as well as elsewhere?

A. Well, gravity, of course, is always operative, but then we have to consider that in order to produce oxidation there is being blown into this mill a blast or gust of air, and inevitably that will have a great effect on what happens, not only in oxidation but in the removal of the product; the air has to go somewhere.

Q. Am I to understand from that answer that the operator doesn't have his option, but he must blow it out? I only want to know which road you take, that's all.

A. Well, if we take the two claims in 149 and 150, it, I think, very clearly states that the operator causes the blast to blow the powder out, and he removes the said powder from the said vessel by means of the said current of air.

Q. Yes. Then Shimadzu in 150 was mistaken in not only what he got, like Berzelius, but he was also mistaken in saying he had an option as to whether he utilized the force of the current to cause to blow the powder formed out of the cylinder?

A. I don't believe I quite understand the question.

Q. I only just want to know one or two things, Dr. Clark. There are two roads that the operator would have to travel; he is at the fork of the road, and I would like to know whether the signpost of this description tells him to go east or tells him to go west. Let's assume, I read: "If it is blown into, it is conve-

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nient to utilize the force of the current thus caused to blow the powder formed out of the cylinder, and then collect it." I want to know merely as to whether I, having this patent before me, am told by anything in it as to whether I have an option to go east or west, or whether there is something in this patent that makes it mandatory whether I go one way or the other?

THE COURT: Well, now, let's get along a little. Of course, Dr. Clark's opinion on that might be worthwhile having, but, after all, isn't that a question the Court has to determine?

MR. WHITCOMB: We were thinking of objecting, but we didn't want to interrupt.

THE COURT: The point is the substance of Dr. Clark's testimony is that he produces lead suboxide in a pure form separate and free. Now, then, he went on into the processes of this patent, and I suppose the examination is perfectly proper to cover the various steps of the process, but, again, we are back to the question of words. Here is a question simply construing words. There is only one claim out of the thirteen process claims that says anything about blowing the product out of the mill. Offhand, it doesn't seem to me that a suggestion in this specification, that it is convenient to use the force of the current to blow the powder out amounts to a limitation of all the other twelve claims. They don't say anything about it, don't claim it, and don't suggest it. That is the way it occurs to me. If Dr. Clark said the other thing, it might have some effect on my judgment, but it wouldn't conclude me.

MR. MORRIS: I am in accord with that thought. I could take a position in regard to that, but I am

not asking him to interpret the claims. Let's pass it.

By Mr. Morris:

Q. Dr. Clark, how many experiments did you make in an endeavor to obtain an isolated Pb_2O, so called?

A. We have made experiments from two Exide samples, Prest-O-Lite samples, and some other preliminary experiments both with water and with oil as a dispersing medium; six or seven experiments.

Q. Why did you select an Exide sample?

A. The pattern of the Exide indicated—that is, the oxide, itself, indicated, of course, the presence of lead oxide, PbO, and lead, and small quantities of Pb_2O as shown in the chart, the blueprint chart there.

It was simply a logical matter to try to extract from the Exide sample, and from a sample made in Shimadzu's mill side by side under the same conditions, any sort of material—of course, we were interested in the distribution of grain sizes to see what similarities or differences there might be in those two products.

Q. What other samples did you analyze beside the Exide sample? Won't you give them to me so I can take them down?

A. Two Exide samples, a Prest-O-Lite sample, and a fractionation of lead oxalate decomposition product. The Prest-O-Lite and the Exide both were conducted in two experiments, one with water and one with oil as a dispersing medium.

Q. And that was all; you made no other tests in an endeavor to obtain the lines that resembled those of Ferrari?

A. That's all the experiments in an essentially pure concentrated product.

Q. I see. They were the only products that you submitted to this supercentrifuge machine.

A. Supercentrifuge, yes.

Q. Two Exide samples, a Prest-O-Lite sample, and one lead oxalate; how many experiments did you make with these several products?

A. The X-ray patterns were made, the microscopic examination was made, the chemical analysis, approximate chemical analysis which we mentioned yesterday, and the studies of the effect of heat in vacuum or inert atmosphere, and the presence of oxygen.

Q. Now, that is the character of the experiments. What was the number of the tests that you made with the centrifugal machine?

A. To date, six. It is a long, tedious process, of course.

Q. You have put six samples through the machine?

A. Yes.

Q. That includes the ones you have mentioned here?

A. Yes.

Q. And those only?

A. Yes.

Q. Will you describe that machine to me as near as you can? It bears a resemblance to a cream or milk separator, doesn't it?

A. Yes.

Q. Same principle?

A. Same principle except, of course, that it is made of very fine tool steel.

Q. To stand the fifty thousand r. p. m.?

A. To stand the fifty thousand r. p. m.

By THE COURT:

Q. You will have to describe it a little more; I don't know how a milk separator works?

A. The type of centrifuge, of course, is a very rapid whirling. For instance, we put milk or liquid, or something of that kind into a suitable container.

Q. I understand what centrifugal force is. What does your machine look like? A cylinder or sphere?

A. It is a small cylinder into which suitable dispersing liquid may be introduced.

Q. Do you put this in liquid form?

A. It must be dispersed as liquid, yes. It isn't an air separator, but it is a suspension in a liquid, and, of course, this is operated through gears and with a motor, and so forth.

Q. Then it is very rapidly revolved; then what happens? What takes so long about it?

A. It is, of course, small, and only a small amount of liquid at any one time can be introduced.

Q. How much?

A. Well, just a matter—it can be made a continuous process.

Q. How much would you put in at a time of these samples?

A. Well, I should say maybe fifty cc., a hundred cubic centimeters.

Q. How many teaspoonfuls?

A. Let's see; half a cupful; something like that.

Q. Then you whirl the machine around; then what happened to the liquid?

A. Then there is separated off any solid material in suspension, very coarse particles are thrown out first to the periphery of the machine. Then any material that is so finely dispersed—that is, we fractionate in stages; and finally after running the same thing through, and through, and through—

Q. Then what happens when you stop the machine? How do you get out those particles?

A. There is a suitable collector; that is, one cylinder inside of another that makes the collection.

Q. Like a sieve?

A. Yes. What we have been interested in here,

especially, is in the liquid which passes on through in which there has been—the final liquid, the liquid phase in which is still suspended a solid so finely divided that it is not thrown out; the particles are not thrown out.

By Mr. Morris:

Q. So the center of it is something like the center of a whirlpool in which the greater masses are hurled to the periphery?

A. Yes.

Q. How large is this mill? I have never seen one. Does it hold liquid, or does it have a capacity of a cupful, a gallon or two gallons, or what?

A. Well, it passes through the rotating chamber, I suppose about a half a teacup at a time. We can put in a given amount and simply run that for any given length of time, say a minute and half, or we may have a large reservoir and admit liquid, and then, of course, take it off continuously, although the given amount which is being submitted to the whirling action is relatively a very small amount at a given time.

Q. I am afraid I don't understand the operation yet. Is there drainage from the bottom of this device from the central portion?

A. Yes.

Q. Constantly?

A. Yes.

Q. And there is an accumulation on the walls of the cylinder?

A. Yes.

Q. So that can be operated as long as you like until the outer wall is so laden with material that you need to start afresh?

A. Yes, you would have to do that after so long a time.

Q. I am a little confused about that, because you

told me a while ago that it took a long time to make this experiment.

A. What I mean by that is this: that we start with a very dilute suspension of powder of this kind. You can't put a large quantity of powder into a given amount of liquid, a very large amount of liquid with reference to the amount of suspended solid in it.

Q. A very large amount of liquid, is how much?

A. That can be, let us say, as much as ten liters to a very small amount of suspended material.

Q. What is the capacity of the mill, of the machine? I am trying to get whether it is a big machine—

A. No, it is small. As I was trying to say, you can operate it as a batch process; in other words, put in a very small volume and then let that finish, or you can continuously admit—

By The Court:

Q. I haven't got it clearly yet. When you say, "let that finish," how does it finish? You put your stuff into the machine and then you start whirling. Is there a dripping out of the bottom, the middle of the bottom, or what happens in the central part?

A. Of course, the liquid which remains flows out into another reservoir below.

Q. That flows out from the center?

A. Yes. That can be readmitted and recentrifuged time after time, as in the case of this experiment.

Q. What is the use of taking it out and putting it back again? Why don't you do it continuously?

A. Well, because, of course, you have a throwing out first of all, in the first instance, the coarsest particles, and each time that you submit this solution of suspension back again into the machine you get another deposit, you see, of a small particle size, and then of a smaller particle size, and so on, until finally you get no separation at all after you readmit it again.

By Mr. Morris:

Q. How long does it take to make one of those experiments, Dr. Clark?

A. Well, we must remember in order to qualify that and answer that, you must remember that we work under an inert atmosphere and this solution in which we are especially interested and from which we desire to collect the product—I don't mean, of course, solution, but the suspension, the liquid phase must be evaporated at a low temperature out of contact with air; otherwise, of course, complete oxidation takes place.

We had very suitable results by using a very low, boiling oil which could be evaporated off in an inert atmosphere, and the suspending and the running of the machine over and over again, and the preparation of this final solid under these very careful conditions runs well into—oh, it takes a couple of days, I should say, for an experiment.

Q. You began experiments with this machine when?

A. In July of this summer.

Q. July of 1935?

A. Yes.

Q. What was the material that you first used in the machine as a test?

A. We used—let me see; I guess we used Prest-O-Lite oxide first.

Q. Then your next was what?

A. Then Exide.

Q. What?

A. The Exide sample.

Q. Now, then, will you turn to your product, Dr. Clark, that you got from this machine and show me the reactions which you got from the product? Will

you be good enough to write out your tests on the opening product that you got in this machine?

(A tripod is produced.)

A. Yes, of course, our first interest was to make the X-ray pattern in accordance with the technique which we developed and which I explained. The second was a microscopic examination. The third was heating a small amount in vacuum. This product which is somewhat light colored, under these conditions darkens to a very dark gray which we have interpreter as this: (indicating), and when we have examined this product under the microscope and we find an intimate mixture of lead and lead oxide.

Heating in open air gives us instantly, almost, the yellow coloration of PbO. Then, of course, we made a chemical analysis of one of the products which, of course, is not very significant, I think.

Q. I missed the last part, Dr. Clark.

A. I say we made a chemical analysis which we discussed yesterday and which I feel is not very significant, any chemical analysis of a product of this kind with a high equivalent weight of lead.

Q. I appreciate your views, but I am interested in chemical analysis. Will you be good enough to take off the sheet you used and lay out another sheet for the chemical analysis, the chemical analysis you told me yesterday you made? I will be glad to have you show me your reactions.

A. Yes, we dissolved—the purpose of treating with acetic acid was simply—

Q. Won't you show me your reactions to the treatment with acetic acid, Dr. Clark?

(The witness writes on the tripod.)

Q. You treated your Pb_2O, so-called, with acetic acid?

A. It dissolves in acid, of course.

(The witness writes on the tripod.)

THE WITNESS: There is some indication in the literature of a monoacitate of lead, but I did not claim this was a monoacitate of lead at all; nobody knows.

Q. Is your formula for acetic acid right?

(The witness writes on the tripod.)

Q. You have counted only for one molecule of lead; what happens to it?

A. What is it?

Q. You did get this identical result as to PbO?

A. I am assuming that, yes.

Q. What have you done with this other atom of Pb that you have in your Pb_2O?

A. This compound reacts as a whole to give us, of course, two lead acitates.

Q. Now, then, you have got four acitates?

A. Oh, you want—

Q. I just want to know what happens. You have this here (indicating), and you have it only twice here, and now you have four of those.

(The witness writes on the tripod.)

THE WITNESS: Of course, it is necessary to state this: this work was done in air, contact with air. We have no evolution of hydrogen, no visible evolution of hydrogen such as we would have if we had metallic lead. This material reacts there as it is introduced and dissolved in acetic acid and PbO.

Q. Then your chemical test gave you stronger evidence of PbO than of Pb_2O?

A. Well, the chemical test merely for the purpose of determining the amount of lead in a given initial weight of lead.

Q. Will you read my question, Mr. Stenographer?

(The question was repeated by the reporter as follows:

"Q. Then your chemical test gave you stronger evidence of PbO than of Pb_2O?")

A. Well, the product in the presence of air acts as PbO, dissolves into acetic acid and leaves a residue.

Q. Will you repeat my question, Mr. Stenographer?

(The question was repeated by the reporter as follows:

"Q. Then your chemical test gave you stronger evidence of PbO than of Pb_2O?")

A. This is not being used as a chemical test for PbO or Pb_2O; that is the only way I can answer that question.

Q. Then the chemical test to which you subjected the ultimate product of your centrifugal machine told you nothing with regard to the existence or non-existence of Pb_2O?

A. It told us the presence of lead in this product with which we started, a value which, if I remember rightly, was 95.88 per cent., a little bit less than the theoretical for the lead suboxide.

Mr. Morris: If Your Honor please, this is

supposed to be a test for Pb_2O. Now, I think my questions are fair.

THE COURT: Well, yes, they are all right excepting he started out with the proposition that the chemical analysis he didn't consider significant, and he says that the only purpose of the chemical analysis was to determine the percentage of lead Pb. If the question can be answered, it is all right; it is a proper enough question. What is the last question?

(The question was repeated by the reporter as follows:

"Q. Then the chemical test to which you subjected the ultimate product of your centrifugal machine told you nothing with regard to the existence or non-existence of Pb_2O?"

THE COURT: I believe you can answer that question, can't you, directly? Did the chemical test, itself, give any indication one way or another?

MR. WHITCOMB: What chemical test?

THE COURT: This chemical test he is talking about. Of course, I refer to the analysis. What do you call it, quantitative analysis?

THE WITNESS: Quantitative analysis.

THE COURT: I am talking about that. That you put in by combining with acetic acid, or whatever it was; did that tell you anything one way or another as to the existence of Pb_2O? Can't you answer that question?

THE WITNESS: The numerical result of the

amount of lead present in this chemical test is roughly in agreement with a formula of Pb_2O.

By The Court:

Q. It did tell you something, then?

A. It did tell us something, yes.

By Mr. Morris:

Q. And likewise in agreement with PbO?

A. No.

Q. Wherein—

A. In numerical results the percentage of lead agreed much more closely with the formula of Pb_2O than it did with the formula of PbO.

Q. Let us see why; your percentage of lead was what?

A. 95.88 per cent., if I remember rightly.

Q. 95.88; do you mind putting it on that sheet?

(The witness writes on the tripod.)

Q. That was Pb?

A. That's Pb.

Q. Now, we didn't ascertain what the remainder was, what the 4.20 residue consisted of; did you insist you were trying this simply to ascertain the amount of lead?

A. That's right.

Q. Now, is there anything in ascertaining that amount of lead, does that tell you that it could not have been a mixture of Pb and PbO?

A. It is entirely conceivable with a mixture of Pb and PbO.

Q. Is it equally conceivable that it could give that percentage of PbO, that Pb_2O could give it?

A. Why, surely.

Q. Did you intend by your answer just a few

moments ago that your ascertainment of the amount of lead was not consistent with the hypothesis of the presence of Pb_2O than with the presence of PbO and metallic lead?

A. And the nature of the initial product.

Q. What do you mean by that?

A. I say this is the conclusion that this is more consistent with the existence of Pb_2O than Pb and PbO, which is derived by the nature of the original substance, an X-ray pattern, a microscopic examination, and so on.

Q. But I am right, then, in my conclusion that so far as the amount of lead is concerned, that it told you nothing as to whether Pb with PbO was present or Pb_2O?

A. Now, the final result without knowing the original product, that says nothing.

Q. What were the other steps which preceded that final thing which indicated to you the presence of Pb_2O?

A. This lead was determined as lead sulphate.

Q. That was determined as lead sulphate; will you give me all your reactions?

(The witness writes on the tripod.)

THE WITNESS: This, if course, was carried out in solution with the best technique that could be used, the sulphate precipitated, collected suitably, washed dried.

Q. All right. Let's start with your treatment of the product in the centrifugal machine with acetic acid. I observe that your first figures that you put there were two molecules of acetic acid with one molecule of assumed Pb_2O. When I asked you for the lead content you changed your molecules of your

acetic acid in number. Does that make any difference in your reaction?

MR. MORRIS: Read the question, please.

(The question was repeated by the reporter as follows:

"Q. All right. Let's start with your treatment of the product in the centrifugal machine with acetic acid. I observe that your first figures that you put there were two molecules of acetic acid with one molecule of assumed Pb_2O. When I asked you for the lead content you changed your molecules of your acetic acid in number. Does that make any difference in your reactions?")

A. I have already stated, of course, that this solution stirred and warmed with acetic acid was done in the presence of air in order to put into solution all the material possible, and it did go into solution, ultimately, the explanation which I give being, of course, that PbO, 2PbO, plus four $HC_2H_3O_2$.

By MR. MORRIS:

Q. What is this compound that you have introduced here; 2Pb of four?

A. No, 2Pb plus.

Q. Oh, thank you. Did you get any free lead as a result of your chemical reactions?

A. There was at first—I watched this carefully as the reaction was going on. The first residue which I could not account for as being due to some other substance present, and the X-ray pattern actually shows the presence of some other unidentified substance. But as the solution was warmed, stirred, the residue went into solution.

Q. Is PbO soluble in acetic acid?

A. Is PbO soluble in acetic acid?

Q. Yes.

A. Yes.

Q. Then that step told you nothing as to whether it was PbO or Pb_2O?

A. Well, the production, if there had been pure PbO, to begin with, obviously, the thing as we know would have quickly and instantly gone into solution.

Q. It would have gone into solution?

A. Yes.

Q. Yours did go into solution?

A. Ultimately, yes, but I said there was first a gradual residue which went into solution with some difficulty, but it finally did.

Q. Did that tell you anything about whether the material with which you were dealing was Pb_2O or PbO?

A. It told us this, that the product was not—that is, in the first instance as it was introduced into the beaker, wasn't pure PbO; it was something else.

Q. It was something else?

A. Yes.

Q. Are you assuming that that something else was Pb_2O that was delayed in reaction?

A. No.

Q. So that the material that hesitated to go into solution, that fact doesn't tell you whether it was PbO or Pb_2O you were dealing with, does it?

A. Well, it tells us this that I just tried to say. If we had in the sample PbO only, of course, that might be mixed with something in the process, but the compound might have been broken down with contact with acetic acid. I don't know what, but something was formed by the beginning reaction.

The fact it all did not act in uniform manner indicates to me, at least, that it was not pure PbO.

Q. It might have been PbO and some lead which became oxidized since this operation was carried on in the open air?

A. Possible.

Q. Did you get any comfort at all, Dr. Clark, out of the chemical reaction so far as the chemical characteristics of your ultimate product are concerned?

A. Not very much, I am frank to say so. If we could depend upon chemical methods in years gone by I think we would know a great deal more about these products.

Q. So far as I can understand you, Dr. Clark, we are no nearer Pb_2O than was Berzelius, when we look at it from the chemical standpoint; when we try to isolate it or determine its presence by chemical analysis?

A. I think that is true simply because nobody has ever had available a pure sample of Pb_2O to be able to know its properties. That is the reason we have turned to these other physical methods.

Q. Dr. Clark, what percentage of a product or an ingredient of a product would probably be shown on your spectogram? What is that word you used before?

A. Diffraction pattern.

Q. Diffraction pattern?

A. Yes. That is an excellent question, one in which all X-ray people are very much interested.

THE COURT: What was the question?

THE WITNESS: How much could you find from—

MR. MORRIS: Will you read the questions?

(The question was repeated by the reporter as follows:

"Q. Dr. Clark, what percentage of a product or an ingredient of a product would probably be shown on your spectogram? What is that word you used before?

A. Diffraction pattern.

Q. Diffraction pattern?

A. Yes. That is an excellent question, one in which all X-ray people are very much interested.")

THE COURT: You mean how much of the stuff must be present in order to show?

THE WITNESS: In order to show, yes. We know that depends, of course, on the nature of the substance, and also upon the X-ray technique which is utilized. The general belief, the general average of difference of one substance to another is probably one-half of one per cent., which is as small amount as could be shown, measured on a diffraction pattern.

In order to tell that, a very considerable number of experiments have been performed in my laboratory recently, especially with regard to the analysis of dust from mines, although this has nothing to do with this case, yet it does have something to do with the technique, in which very small amounts of silica, and things of that kind, are of importance and interest. I think we can place safely one-half of one per cent to one per cent. as an amount which can be registered particularly by use of a microphotometer on the films.

By Mr. Morris:

Q. Doctor Clark, generally speaking you feel you must have one-half to one per cent. of material as one of the components of the mixture in order to have it show up on your diffraction pattern?

A. That's right, without any doubt.

By The Court:

Q. May I ask a question at this point? This testimony of yours as to the experiments you conducted and what you find amount to practically a discovery, don't they, scientific discovery? Nobody else has ever X-rayed or seen this stuff?

A. Well, that's the way we feel about it.

Q. Would you say generally, without regard to this case it was a scientific discovery of some importance?

A. I think the application of the centrifuge method and the settling of a moot point as to the existence of an unstable compound represents a discovery.

Q. I mean is it a discovery—that is to say, the existence of the unstable compound, Pb_2O; is that a discovery that the world is apt to take note of?

A. It would be, I think, if it were published in a suitable scientific paper; it would be received with interest.

Q. Other people would be apt to duplicate or attempt to duplicate your experiments?

A. Yes, they would.

Q. To check up?

A. An illustration of course, is the fact that since the paper by Ferrari there have been half a dozen, six or eight or more papers trying to check him—

Q. Pardon me, what was the paper by Ferrari?

A. Ferrari was the man who made the first X-ray analysis and reported a crystal structure of lead suboxide.

Q. Oh, yes; that was at what time?

A. 1926, if I remember rightly, or '27.

Q. All he reported was crystal structure that was consistent with Pb_2O?

A. Yes, and the difference from lead and PbO, or the combination.

Q. Did you have more than he had in his lines?

A. No.

Q. I mean did he have as much as you had?

A. I don't believe, as we can mathematically analyze his spectrum, the lines correspond fairly well. Of course, we have what we think to be more accurate numerical data.

Q. Is that the only advance you have made over his?

A. We have proved or checked his assignment of a crystal structure similar to Pb_2O and Ag_2O that is consistent with our results.

Q. In other words, what did you do that he couldn't do? What have you got that he couldn't get, or what have you shown he couldn't show?

A. Well, the only thing that we could do would be simply, in the light of scientibe advance in apparatus, do something just a little more accurately.

Q Did he have a centrifuge?

A. Oh, no. He started with lead oxalate. It was his belief, he states in his paper that his product was practically pure suboxide of lead, and he got this cubic spectrum corresponding with Pb_2O and Ag_2O.

His work followed van Arkel, another X-ray man who investigated oxide mixtures. His experiments

were consistent with lead plus PbO, so there was a controversy, you see. Ferrari mentions this with the previous work of van Arkel in his paper.

In the paper it states he allowed his samples to stand some period of time, and he noted a change in the spectrum with the appearance after a period of some months, I think, seven or eight months, of lines corresponding to lead and Pb_2O.

Q. Now, you, as I understand it, started in with a machine which would isolate this substance if there was such a substance in existence; you used this machine and you got something in the final product. You took that thing and put it through your X-ray, and you got the same structure that Ferrari had gotten before you?

A. Yes. We had also found in the mixed samples, that is, the ordinary samples from the mills, and from lead oxide experiments we had obtained a mixed spectrum consisting of lead lines, of PbO lines, and of additional lines. These additional lines corresponded very well with the lines which Ferrari had reported.

Q. You had the advantage over him of starting out with something that was theoretically or provisionally free and pure; he didn't have that advantage?

A. He prepared him samples from the oxalate. He didn't know what he had until he subjected it to X-ray analysis.

Q. He didn't have the fractionating process?

A. No.

Q. These photomicrographs, did he have that?

A. Nothing reported in his paper.

Q. He could have?

A. Yes.

Q. But they are not reported?

A. That's right.

By Mr. Morris:

Q. What were some of the disadvantages of the X-ray test, the inaccuracies of the X-ray test, or is it perfect?

A. There are errors, of course, that must be recognized as follows: we must know or be able to calibrate very perfectly the radius of the camera which is used, since the position of the lines on the spectrum depends upon the distance, very accurately on the distance from the spectrum to the film, and any machine, camera of that sort, obviously, it would be a very limiting condition if it could be made absolutely perfect, perfect cylinder, or circumference, or something of that kind; that must be recognized, of course; shrinkage of the films, variation in the films. We can use, of course, in that sort of thing, for calizbration purposes, under exactly the same conditions as nearly as we can get them some standard very pure substance whose pattern can be produced, whose specifications are well known.

By The Court:

Q. Pardon me a minute. Does the X-ray report anything but the crystalline structure?

A. Well, that is in essence, that composite information is the crystalline structure.

Q. That is what you get; in other words, you may have that same crystalline structure with a number of substances?

A. You may have the same general architecture by the different ones in the sizes of the atoms; for example. I—

Q. I understand that statement, but what I was getting at was this: you start with lead an you know it is only one crystalline structure that will fit Pb_2O, of course, lead oxide. Suppose you didn't know the thing you were looking at was lead; suppose it might have been iron, aluminum, or a number of other minerals and you didn't know what it was. The X-ray plate for the lines wouldn't tell you what the element was you were dealing with; would would have to know that first, or am I wrong?

A. Not necessarily. Of course, there has grown up in the last few years a large compendium of information just like tables—they are tables in which are listed under a given crystal structure producing a given pattern, for example, very accurate numerical values corresponding with distances between plates.

Q. That may be different for different elements?

A. Oh yes. One single value distinct for each compound so that if that compound were known or had been studied it is already available in well known tables.

Q. In other words, you could take a powder you had no information as to what it contained and you could come close—by getting its crystalline structure you would be able to tell not only what particular oxide it was, but you would be able to tell what it was?

A. Yes, if there is data available, and there are many now.

By Mr. Morris:

Q. With no options?

A. I would maintain this in answer to that question: if a given substance, pure substance had been worked upon carefully in an approved laboratory

with approved methods by skilled operators, and certain numerical data were derived from those X-ray experiments by these skilled operators, skilled scientists that represents—that is the forms of crystalline axis and the alpha beta gama angles between axes, and so forth, would be distinctive for that substance. It is true there are some substances very close together, and unless work were very accurately done it is possible to confine them.

Q. Running to the third decimal point, perhaps, or second?

A. Section decimal point, perhaps.

Q. So that inaccuracy in the machine or operator going to the second decimal point might indicate one substances while the substance present is another?

A. That is possible in rare cases.

THE COURT: I think perhaps we might as well adjourn here.

(Recess was taken from 12.30 o'clock P. M. to 2.30 o'clock P. M.)

AFTER RECESS.

GEORGE L. CLARK, recalled.

Cross-examination (Continued).

By MR. MORRIS:

Q. Dr. Clark, which are the physical properties that are given in these specific patents in suit that you find in defendant's product?

A. First, the defendant's product may be characterized as reactive, as shown by the increase in weight and the various figures which were presented yesterday after noon, in simply a change on standing for twenty-four hours. It may be characterized by fineness of subdivision. It may be characterized as oxidized lead powder containing lead and oxygenated or oxidized lead compounds. It is characterized by having present small amounts of lead suboxide, even as finally obtained from the mill.

Q. How did you determine the amount of so-called lead suboxide in defendant's product?

A. The amount in the defendant's product was determined from the X-ray patterns, by use of the microphotometer curves, by comparison of intensities of lines.

Q. That would give you as accurate a determination as a chemical analysis?

A. I think it would give equally as accurate analysis for lead suboxide as any chemical analysis could, and that can be further qualified by saying that the lead suboxide is, at least, we think, identified as such in these mixtures, and its own concentration determined by this method.

Q. Do you look upon the X-ray analysis as auxiliary to or a substitute for chemical analysis?

A. Well, in this—in this case, where we are dealing with a compound, whose identity is uncertain, where it is present not as pure compound, but in mixtures, I should—I personally feel, after thirteen years of working day by day with X-ray methods, that it gives a more accurate picture of the state of affairs and the amount of substance than a chemical analysis could, and in so saying I do not wish to seem a traitor to the cause, by any means.

Q. A traitor to what cause?

A. To the cause of classical chemistry.

Q. A traitor to the cause of classical chemistry?

A. Yes.

Q. Is that equally true of any other substance that has come within your knowledge?

A. There are very many substances, at any rate, of which I may mention especially mineral mixtures, ceramic materials, soils, and all similar products, natural products whose chemical analyses, especially as regards the exact identity, the exact form in which a given substance is present. Chemical analysis does not give that to us directly. The X-ray diffraction analysis gives us the information concerning the identity of the compound, not only as a certain chemical substance, or chemical compound, but the way in which it is combined, its absolute identity as such in that solid.

Q. You spoke of the reactivity; is reactivity with a mixture of PbO and lead a matter of proportion or ratio? Is the degree of reactivity of a mixture of PbO and lead dependent in part, at least, upon the relative percentages of the two?

A. Yes, it is in part on the presence of unoxidized metallic lead, and also in part, of course, upon the fineness of subdivision.

Q. Well, the reactivity is a function in part, at least, of fineness, isn't it?

A. It is.

Q. Then if you had finely divided lead would it be reactive?

A. It would be, yes.

Q. Did you apply—

By The Court:

Q. May I ask a question?

A. Yes.

Q. All these claims of the patent call for a high degree of reactivity. Now, is that desirable in itself, or is that just something that goes with the fineness of the powder? Is the thing that you want in the commercial product fineness or reactivity?

A. Well, those are so parallel it seems to me in this case that you cannot separate one from the other.

Q. Well, but—I agree that they go together,—

A. Yes.

Q. — I understand that, but what do they want to get, really, what is the thing that they want? Do they want a fine powder, is that the important thing, the physical structure of the powder itself?

A. That is what they want for battery purposes.

Q. Now, what is the advantage of that? Why do they want it so v ry fine?

A. Well, as the chemical engineers who are acquainted with the storage batteries can tell you, a very fine material is a very great advantage, particularly in its cementing action in plates, and, of course, the rate at which paste can be formed and set up, almost a jelly.

Q. Well, it is really the physical quality that they are after, the fineness; the reactivity is something that goes with that?

A. Yes, of course, the second thing which must be added to that is that it is then very easy to take this product, very finely divided, and with very simple means subject it or get it at any stage of oxidation which may be desired for any particular purpose.

Q. All right.

A. The point is simply this, if we had little,

tiny lumps of lead that you could see in a microscope, those aren't very reactive, those wouldn't do anything.

Q. But those wouldn't be as good—

A. No.

Q. — for your cementing purposes?

A. No, they would not.

Q. The plates would crack?

A. Yes, and, of course, metallic lead would stay there unchanged.

Q. Yes.

By Mr. Morris:

Q. Did you find any of our product, defendant's product, was spontaneously converted into litharge by merely exposing it to air?

A. Yes, it is.

Q. What percentage of litharge did you find in it to begin with?

A. Let's see, there was thirty-seven per cent. of metallic lead, which in twenty-four hours was reduced to twenty-two per cent. of metallic lead, a change of some fifteen or sixteen per cent.

Q. That was in how large a quantity?

A. Those figures are given in Dr. Wilson's report.

Q. That was a question of grams?

A. Yes.

Q. And was not a question of tons?

A. That is right.

Q. So that there would be no such change in the commercial product?

A. Well, if we would take, of course, a great massive quantity, deep down, or something of that kind, obviously the oxidation takes place superficially,

depending upon the penetration of air, and the average oxidation if you take the average of the whole mass probably should be less than this quantity.

Q. You found thirty-seven per cent. of pure lead, you say,—

A. Yes.

Q. — or lead powder?

A. Yes.

Q. And sixty per cent. of—

A. Sixty-three per cent. of PbO.

Q. Litharge?

A. Red tetragonal.

Q. Red tetragonal litharge. Now, did you find that that product, I am not speaking about metallic lead now, but the product as a whole was spontaneously converted into litharge by merely exposing it to air?

A. Well, of course, the product as a whole is not spontaneously converted, because some of it is already there.

Q. I mean—

A. That is, sixty-three per cent. of it is already there.

Q. Did you find it would ignite and burn when you subjected it to the heat of a match?

A. It does not.

Q. Did you find that—what was its reactivity or degree of reactivity when subjected or treated with a drop of water?

A. Not very much change, a slight change in color, if you put a thin layer out on, say, a watch glass, and add a drop of water, there is an easily indicated change away from the olive-green type of material towards a more nearly pure yellowish litharge color.

Q. Would that be the result of any change in the body of the substance, or only a further oxidation of the fine particles of lead, the thirty-seven and one-half per cent. of lead?

A. Well, that is the primary change concerned, of course.

Q. That is, if you spread it out so the drop of water will not be—so that the drop of water can reach the thirty-seven and one-half per cent. of metallic lead—

A. Yes.

Q. — it will oxidize that?

A. Of course, in contact with air.

Q. In contact with air, of course?

A. Yes.

Q. Well, you answered me, it would not ignite. Were there any other properties which you found, physical properties or other properties which you found in our product which are described as the characteristic properties of the product of the patents in suit?

A. Well, there is—from the observations and experience, not from direct use myself, or trial, of course, very suitable for use in storage batteries.

Q. Are you an expert in storage batteries?

A. No, I don't claim to be that.

Q. Are you—

A. I am just simply telling you—

Q. Are you speaking of your own knowledge about material suitable for storage batteries?

A. I know that it is good for storage batteries.

Q. You do know that it is good?

A. Yes.

Q. Have you your calculations and measurements for the tests which you made with respect to lead and lead oxides by your X-ray method?

A. I will be glad to submit here a numerical calculation of a pattern for Exide oxide as a typical type of analysis, numerical analysis, which we have used in this case.

Q. This is the same analysis as is represented by your—that is represented by the spectogram number 9 on Plaintiffs' Exhibit 21?

A. That—

Q. I am not sure whether 9 was the—

A. This calculation, this particular calculation, is for the whole oxide.

Q. For what?

A. That is for the oxide itself, the initial substance, lead, lead oxide and Pb_3O.

Q. Now, did you say this was for the Exide?

A. Yes.

Q. And that, you say, is represented by which one of these spectograms of diffraction patterns on Exhibit 21?

A. Well, whichever one says the Exide, that is a typical analysis.

(The witness indicated the spectogram.)

Mr. Morris: It is number 6. May I have this marked for identification? This is defendant's for identification A, right here, and that is B. Will you mark it?

(Formulas written on the easel by the witness Clark were marked Defendant's Exhibit A for identification.

Numerical calculation of pattern for Exide oxide was marked Defendant's Exhibit B for identification.)

By Mr. Morris:

Q. Have you your like measurements for number 7?

A. Number 7 is what, there?

Q. Number 7 on Plaintiffs' Exhibit 21, which is number 3, after moistening with water and drying in a vacuum, and number 3 is tetragonal PbO.

A. Well, I don't happen to have those calculations here, no.

Q. Will you be good enough to get them for me?

A. Yes, I can get all those.

Q. What others have you here? Have you number 9, which is a finer fraction of finely divided number 3?

A. Yes.

Q. May I have those, please?

A. Those have all been calculated in the same way.

Q. May I have that one, please?

A. I have just that one representative sheet here. We have all the data in books.

Q. Have you the books where you made your data and calculations?

A. Yes, I can present them.

Q. You will bring them?

A. Yes, I will.

Q. This is the only one that you have here?

A. Yes.

Q. Now, did you make any X-ray patterns, diffraction patterns, for any products other than those disclosed on Exhibit 21?

A. Yes, those, the actual films, are in evidence for many more samples than that, and then, of course, we have made, as I said, in the course of this whole investigation possibly five hundred exposures.

Q. What other products did you analyze spectographically—would that be a correct term? No, it isn't—by the X-ray process?

A. By diffraction method, yes.

Q. Diffraction method.

A. Well, as I said yesterday, we did about one hundred and twenty-five lead oxalate experiments, and, of course, we have had a large number of samples under varying conditions from Shimadzu mills in this country and from Japan, and numerous experiments which we ourselves did with these materials.

Q. When were those diffraction patterns that are shown in Plaintiffs' Exhibit 21 made?

A. Those were made at different times, all of which, the dates of which are indicated on the films in evidence. Outside of the three fractionated films there and that one in which there was moistening with water, those were all made in the summer and early fall of 1934. The others, of course, have been made just two or three weeks ago.

Q. These were made, including 9, 10 and 11, were made in 1934?

A. 1935.

Q. 1935?

A. Yes.

Q. And all the others were made in 1934?

A. Yes, with one, possibly one exception, that one moistening with water was just recently.

Q. That is number 7, which is number 3 after moistening with water and drying in a vacuum?

A. That is right.

Q. Sot that was made recently?

A. Yes.

Q. Perhaps August, or early September.—

A. Yes.

Q. —1935? Dr. Clark, I wonder if you will be good enough to help me out a little bit with this statement in Dr. Wilson's report? At the bottom of column two on next to the last page of the report I read this:

"Dr. Clark on the other hand states that—

MR. MORRIS: Has Your Honor that?

THE COURT: Yes.

MR. MORRIS: It is next to the last page, the last paragraph on the next to the last page.

THE COURT: Yes.

BY MR. MORRIS:

Q. "Dr. Clark on the other hand states that he has found lines in the X-ray spectra of these samples, some of theme quite well marked, which do not correspond to the lines of either metallic lead or tetragonial litharge. On the basis of his observations, any extended discussion of which will be omitted at the present time, he concludes that lead suboxide (Pb_2O) is present in this mixture and assigns to it, on the basis of his calculations, the cuprite structure."

Have you arrived at any different conclusion since that informaion was given by you to Dr. Wilson?

A. No.

Q. What is the cuprite structure?

A. Cuprite structure is that which corresponds to the cubic structure corresponding to Cu_2O, represented in the lattice picture which we presented yesterday in which there are face centered cubic metal atoms with oxygens interspersed.

Q. What do you mean by face centered, Doctor?

A. The unit of crystal structure of lead is—metallic lead, that is, the last subject unit of the crystal is a small cube, with an atom of lead at each corner and one in the center of each face.

THE COURT: Judge, are you going to read him the balance of this paragraph later on?

MR. MORRIS: I can do it now; be glad to do it.

THE COURT: Well, I was rather interested to see whether that still represents—because tha is apparently—

MR. MORRIS: Well, suppose I do it now,—

THE COURT: Well, all right.

MR. MORRIS: —or will Your Honor do it?

THE COURT: No, you go ahead.

MR. MORRIS: Will Your Honor do it?

BY THE COURT:

Q. Well, I just want to go ahead with this statement. After "cuprite structure" Dr. Wilson goes on to say:

"However, he believes that the suboxide can not exist in the pure state but is always in equilibrium with metallic lead and litharge according to the equation Pb_2O equal $PbO+Pb$."

That is not "equal", that is the other mark; what do you call the other mark?

A. The arrow marks, you mean?

Q. Yes.

A. Equilibrium.

Q. Equilbiriam. Did you give that information to Dr. Wilson at that time, at the time he made that report?

A. Yes.

Q. Does that still represent your—

A. Yes.

Q. You say it cannot exist in the pure state. Am I off—

A. Well, that— that was the information given to him at the time of this—when this report was written. Of course, the subsequent fractionation, preparation of a phase nearly pure, is a very late development.

Q. Well, I mean, does that—

A. Yes.

Q. —sentence that I just read represent your views today? I thought, I thought that you had come to the conclusion that it could and did, through your fractionation, exist in the pure state.

A. Yes, that was exactly right. Of course, the intimation, it seems to me, here, or the implication, which is still correct, is that lead suboxide as prepared in various chemical processes such as with lead balls and air, or from lead oxalate, does not exist in a pure state.

Q. It can only be—only be gotten by fractionation?

A. Yes.

Q. You do say that you get it in a pure state by fractionation, is that it?

A. Practically pure, yes.

Q. Practically, pure.

THE COURT: All right, Judge.

By MR. MORRIS:

Q. Then, why cannot it be proved and demon-

strated by chemical process as well as by the lines of the X-ray photograms?

A. I beg your pardon, Judge Morris, will you please ask that—

Q. I will withdraw it. What samples did you use in making spectograms 9, 10 and 11 on Plaintiffs' Exhibit 21?

A. What samples did I use?

Q. Yes, where did you get your samples?

A. Those are, those are—9, 10 and 11 are the fine fraction, is that it?

Q. That is right, I will show them to you.

(Plaintiffs' Exhibit 21 was shown to the witness.)

A. Those samples were prepared by us from the non-settling fraction in a super-centrifuge from original mill oxides as designated.

By Mr. Morris:

Q. Did you run the centrifuge yourself?

A. I did.

Q. Did you prepare it for this test?

A. I did.

Q. Did you make the preparation of the liquids which went into—

A. Yes.

Q. —these tests? You did that personally?

A. I did.

Q. Did you do your own measurements afterwards?

A. I did.

Q. So that what preparation was there to be made for the machine before the tests were made?

A. Simply a dispersion of the material in the liquid medium, which, of course, was carefully done,

out of contact with air, and this suspension prepared by—in that way was then subjected to a super-centrifuge. This super-centrifuge belongs to the Geological Survey of the State of Illinois, it is not a part of the chemistry department's equipment, and their expert, of course, ran the machine.

Q. What oil did you use?

A. This was a low boiling petroleum ether.

Q. Low boiling petroleum ether?

A. Yes.

Q. What would be the chemical composition of that, generally speaking?

A. Well, that is essentially pure hydrocarbons.

Q. Pure hydrocarbons?

A. Yes.

Q. From which all air had been eliminated?

A. Yes.

Q. Where did you keep your samples that you had from 1934 until August, 1935?

A. They have been kept sealed in the dark in my files, very carefully sealed, with stoppers, just as received.

Q. What kind of stoppers did you use?

A. The stoppers received from Dr. Wilson were, if I remember rightly, paraffin stoppers, paraffin coated.

Q. Did you take your samples from the same container that you had used in making your examinations in 1934, or a different samp" ?

A. From the same sample exactly.

Q. The sample, then, that you used in 1935 for making these tests then had been opened?

A. It had been opened long enough to—in 1934—to remove a small quantity for the X-ray examination.

Q. And what was the size of the container from which you took the sample?

A. These were sent to us in test tubes approximately a foot long. The samples were obtained at the mill, and in order to be kept dry were placed over P_2O_5, phosphorus pentoxide, with a suitable cotton or porous plug.

Q. Doctor, you are talking about the powdered sample, now, or the ball?

A. Well, powder sample; and the ball, of course, was shipped in a sealed—one ball we received was shipped in a sealed tin can, the other was shipped in a glass vessel in which there was P_2O_5, a glass wall.

Q. No, but I didn't know that, my difficulty is that I didn't now any pentoxide, if that is what it was, was used in connection with the powdered samples, I thought they were sent sealed and that substance was used only in the cans in which the balls were placed. Am I wrong about that?

A. These—these samples which we discussed yesterday all have—all are sealed oxer P_2O_5, in order to be kept very dry.

Q. I see. Have you yet told me, Dr. Clark, whether you have a list of the interplanar spacings for all of the materials you have investigated by the powder method of X-ray analysis?

A. They are given on the—

Q. The books that you are going to produce?

A. Yes, and they are given on the sheet which you have.

Q. As to one sample?

A. One sample, yes.

Q. You have given me that, now, then, the others you are going to produce.

Have you calculated the so-called X-ray density of the so-called lead suboxide?

A. The X-ray density—let me see, we did that quite a long while ago.

Q. That is, you didn't do it with respect to your so-called isolated product of August, 1935?

A. No, we are expecting to do that. We haven't done that as yet.

Q. What might that tell you affirmatively or negatively?

A. That information I think would be very valuable, because if we do assume for the moment that the substance Pb_2O crystallizes in a cubic lattice, of course, it is eas to calculate its ideal density from the size of its unit cube.

Q. Then, as I understand it, your stated conclution of the separate existence of the compound Pb_2O is still based on some assumptions?

A. No, I am just—I am simply stating that you are assuming it.

Q. I am afraid we are at cross purposes for the moment, then. Would you be able to definitely conclude that, even in your own opinion, that this centrifuge product is Pb_2O, unless you based it spon the asshmption thta it has a cuprite structure?

A. Well, the cuprite structure is one factor, it is a combination of behavior of the results of these other experiments, which leads me to conclude in my own mind, at least, that there is every reason—that is, perfectly reasonable that such a substance exists and that such a substance is in this centrifuge sample in essentially pure form.

Q. But I am still at a loss, Dr. Clark, that if nobody has determined from an isolated Pb_2O product that it has a cuprite structure, I still don't understand why you can give to this hitherto unisolated and undiscovered product, why you can assign to it the cuprite structure.

A. Well, it does have the cuprite structure.

Q. That is, of something which has never been found before, you can say that it has a cuprite structure, or are you speaking of the stuff that you analyzed with the X-ray spectogram?

A. Well, the spectogram which we produced—

Q. Shows a—

A. —shows a pattern of a cuprite-like type of substance, plus additional lines of another substance.

Q. Yes.

A. Unidentified.

Q. But I am still lost, Doctor, and if you will just have a little patience with me, because I don't know this art as you do, but with something that you have never isolated, and no man before you had ever isolated,—withdraw that, and let me try it this way,—so far as you know Pb_2O had never been isolated prior to August, 1935. Am I right in that assumpaion?

A. Ferrari claimed its isolation.

Q. Well, I gathered this morning in answer to His Honor's questions you claim the discovery in some way. Now, am I wrong about that?

A. No, that is right, Ferrari—Ferrari's specimen also contained lines of metallic lead.

Q. So Ferrari didn't have it isolated?

A. No.

Q. So, not having it isolated, was he able to determine definitely what it was?

A. Of course, he—he found, of course, the first thing that he did was to find all lines of metallic lead which could be subtracted from a total composite of lines. The residue of lines upon analysis with various careful analysis with quadratic equations, and so on, fit a particular type of structure.

Q. Yes.

A. To which he assigned, and which was a cuprite structure.

Q. Yes.

A. Or a cuprite-like type of structure.

Q. Yes.

A. He simply stated upon the basis of—

Q. Assumption?

A. Of previous knowledge in the literature, that this material was lead suboxide, because it certainly was not PbO.

Q. Have you done any more?

A. We have prepared or attempted to prepare, I think we have prepared by the fractionation method a sample free from that.

Q. Free from what?

A. Free from metallic lead and from PbO, essentially.

Q. Now, I didn't—

A. And which gives, it is perfectly true, a double—a mixed sepctrum, there is some other substance there present in small amount which we have not been able to identify.

Q. Now, I didn't understand that you were able to say that you had produced this free from metallic lead, and do you now say so?

A. This super-centrifuge fraction is essentially free from metallic lead.

Q. What do you mean by "essentially"?

A. It gives no measurable evidence on an X-ray fraction pattern of characteristic lead lines, that is, the whole pattern.

Q. You are speaking from a spectogram and not from the chemical analysis?

A. Yes.

Q. Well, I still am a little in the dark, Dr. Clark, of why when Farrari assigned to this a cuprite struc-

ture—withdraw that—this is what I don't understand, why if the lead suboxide had not been isolated prior to Ferrari that he, even if he found under his spectogram, under his X-ray treatment a product that had the cuprite structure, I don't understand how he could say or how you could say that the cuprite structure which was found by each of you was metallic lead?

A. Was—

Q. Was Pb_2O.

A. In order to answer that question, of course, you must combine with this observation that you have a cuprite structure a certain new chemical substance, certain interplanar spacing, certain lattice constant, and so forth, combined with that the behavior of the sample. In chemistry when we cannot deal with a static system and we are unable to get enough information from the system as it stands we very frequently resort to a study of change which takes place. Such he has done and such I have done.

Q. Do you depart from Ferrari? Don't you take the same assumptions in yours that Ferrari took in his in arriving at a conclusion that the name given to this, to a product by Berzelius, was indeed Pb_2O? Are there no assumptions unproved which lie at the foundation of that conclusion. That is a pretty broad question, Doctor.

A. Yes.

Q. And it is so broad that I would like to have it read to you.

(The question was repeated by the reporter, as follows:

"Q. Do you depart from Ferrari? Don't you take the same assumptions in yours that Ferrari took in his in arriving at a conclusion that the

name given to this, to a product by Berzelius, was indeed Pb_2O. Are there no assumptions unproved which lie at the foundation of that conclution? That is a pretty broad question, Doctor.")

A. Well, let me answer that first by way of analogy. Suppose that, suppose that a man discovers a new—a new chemical element, by magneto optical effect, or by an optical spectogram, or something of that sort. There are certain a priori predictions that can be made, certain laws which will govern, which will assist in setting up certain predictions as to the identification of such new chemical element, previously unknown, whose properties are unknown except by reference to a periodic table, or something of that kind. When such a prediction is made, in which calculation of a spectrum line is made, and upon a spectogram a line like that appears, chemists in general accept that as evidence of—based up on the possibilities of departure from chemical laws, having to take that into consideration, of course, obviously, they accept that as evidence, at least, the primary evidence that a new chemical element exists in this particular mixture.

Well, then, of course, it takes years with the new chemical compound before its properties are all known, it takes years. It must be isolated, it must be isolated not by one man, but by many men, it must be measured in every possible way, it must be studied from every chemical and physical point of view, until there is general agreement upon it.

By Mr. Morris:

Q. Now, has that period arrived with respect to the Pb_2O?

A. It has not, I am perfectly frank to say.

Q. Indeed, you and Ferrari are the only two people, so far as you know, in the X-ray field who have kindred conclusions, aren't you?

A. So far as I know; there are other X-ray papers, other X-ray men who have worked who produced patterns which are very proximate, for example, LeBlanc and Eberius, very rough patterns, from which they conclude the non-existence of any large amounts of Pb_2O, but by looking at their line drawing I don't think that anyone would care to place very much reliance in that type of evidence.

Q. But their standing in the scientific field is good, bad or indifferent?

A. Good, very good.

Q. Now, there are others, am I right about Derbyshire, or was he over in the chemical field, how many others have tried to follow Ferrari and couldn't?

A. Let me see, there is LeBlanc, and Eberius, there have been two or three other papers by German and French people.

Q. About a half a dozen, aren't there?

A. Yes, something like that; I don't remember the names at the moment.

Q. Do you know whether Ferrari was ever repeated or attempted to repeat his experiment?

A. I have had some correspondence with Ferrari two or three years ago. Just as he has, just as we have found and he has found from his oxalate experiment, it is exceedingly difficult to reproduce, because of the extreme sensitiveness of the process to such a quantity of lead suboxide as he claimed in his first experiment but he has by no means dismissed or accepted—he has by no means dismissed the fact that Pb_2O does exist or is formed.

Q. That is, that was his conclusion, and he is standing by it?

A. He still stands with it, yes.

Q. But that doesn't tell me whether he has told you as to whether he has repeated his experiment, subjected it to another test treatment at his own hands.

A. Well, he hasn't definitely enough stated so that I could make any conclusion.

Q. Then if I understand you aright, you have not been able, even experimentally, to determine so far the actual density of this so-called lead suboxide.

A. It has not yet been done.

Q. Then if I understand you aright, also, you do not now know that your calculated value fits in with the lead suboxide picture, do you?

A. No, we don't know, that is just another step that has to be done.

Q. So would you expect, Dr. Clark, as a scientist that the scientists of the world would in large measure accept a conclusion now that lead suboxide exists, until those assumptions which we have been dealing with, and lack of data, have been determined?

A. Well, I am perfectly frank to say that I should not want to publish a paper until these further measurements have been made, until we get molecular weight determination and various other things. We can say, I think it can be, could be accepted—

Q. Do you think a person's business should be perhaps—

THE COURT: Perhaps he was going to finish that.

By THE COURT:

Q. You can say something: what is that?

A. I say I can say from X-ray examination,

from the chemical measurements we have made, chemical studies, and the microscopic studies, that there is a new substance, a third and different substance, corresponding not to lead and not to lead oxide, PbO, which logically corresponds—which is an oxide—which logically corresponds to the type of thing in which oxygen enters a lead lattice, which is easily oxidized to a known substance in air, which has a different refractive index from PbO or metallic lead, which has a different, entirely different microscopical properties, which produces a different X-ray pattern, which is common to all of these substances, fractionated and un-fractionated.

By Mr. Morris:

Q. Then would this statement be about where you stand at the present time, Dr. Clark, or not, that from your recent calculations and experiments and observations, that you have found some evidence which would lead you, and you think should lead other scientists to be less surprised if it should be established that Pb_2O does exist as a chemical compound?

A. Why, I think that is a perfectly just statement.

Q. Let us pass to some more assumptions or established data, whichever you tell me they are, but I have been interested in the heat of reaction. That is, perhaps, one criterion, am I right in that?

A. The heat of reaction, may I ask, of what?

Q. Of this material which is under discussion, to wit, the Shimadzu product when subjected to treatment with acetic acid, for instance, would that be an endothermic or an exothermic reaction?

A. What is that again, lead oxide—

Q. When lead, PbO, is treated with acetic acid does the reaction give off heat—

A. Yes.

Q. — or absorb heat? Is it possible to measure in calories or otherwise the heat that is given off by such reaction?

A. Why, certainly.

Q. Did you measure the heat that was given off by your isolated Pb_2O?

A. We haven't yet made calorimetric measurements.

Q. So, again, your testimony so far has been given without complete check of all the things which should be applied in determining the existence or non-existence of Pb_2O?

A. Calorimetric measurements and other things not yet completed are all valuable in adding to the complete and final story.

Q. Or subtracting?

A. Yes, or subtracting.

Q. But the heat of reaction has been measured, or, haven't some of the people, prior people, who have been studying this fluid measured or said that they have measured that heat of reaction?

A. I think I remember so, yes.

Q. Maybe Tanatar was one?

A. Yes.

Q. Have you based your conclusions so far given at all on anything that Tanatar did or said?

A. Tanatar's work, it seems to me, was a very interesting piece of work, 1901, possibly the most accurate measurements of heats of reaction and things of that sort up to his time in this field. Of course, he found that depending upon the way in which the preparation was made he would get widely different results, he could produce a product in which lead would not be extracted by mercury.

Q. I am wondering if Pb_2O is such a fugitive compound, even assuming its existence, if Tanatar had not been able to isolate it, how he knew that he was taking the heat of reaction of Pb_2O. Can you tell me?

A. Well, his, I think, conclusion was based upon the fact that a sample prepared in which, if I remember rightly, the air was, or the stream of carbon dioxide gas was passed over his product continuously, so as to remove carbon monoxide, his assumption was, I think that is about all that could be said. the assumption was that one of these products, black in color, from which lead was not extracted by mercury, gave a certain heat of reaction. When, however, he made the product by another method, another temperature—not by another method, but under different conditions, getting a more olive green substance, he did get a different heat of reaction. If I remember right he subtracted one from the other.

Of course, his work has been criticized, probably justly, because of the possibility of formation of carbonate in his CO_2 atmosphere.

Q. That is as I understood it, so you would not want to stake your reputation, would you, Dr. Clark —

A. Oh.—

Q. —on saying that Tanatar had Pb_2O?

A. — I don't, I am not.

Q. I thought not. Well, there is another man who gave us something about calories, didn't he, and heat of reaction, wasn't that Hershkowitsch, or something like that, name?

A. Hershkowitsch, in 1921, yes, sir.

Q. Would you care to make any different statement with regard to what he did than with regard, you just made with regard to Tanatar?

A. Well, his conclusion, of course, was—he got a heat of reaction, that is, difference of heat of reaction between so-called lead suboxide and lead oxide, which is different in sign. He ascribed that not to erroneous measurements upon the part of Tanatar, but simply, probably, that Tanatar's product was contaminated. Those, of course, those, of course, I don't have in mind. I have a translation of the—

Q. Well, all these men who in prior years published their experiments or the result of that were using Berzelius, so-called Berzelius suboxide, weren't they?

A. If you will permit me to make a slight change, we have been blaming Berzelius for a good any things. He was a great man. As a matter of fact, due just inadvertently to faulty memory yesterday, the first man who really did a comprehensive oxalate experiment was Boussingault. Berzelius was the man who first mentioned lead suboxide by the rusting or the dulling of metallic lead in air.

Q. The man prior to Berzelius was what time, Boussingault, whatever his name is?

A. Boussingault, yes.

Q. What was his period?

A. Well, he was later than Berzelius. His was, I believe, in 1850, around, something like that.

Q. Berzelius was 1830—

A. Yes.

Q. — to 1840, something like that, so that notwithstanding Pb_2O has been discussed by scientists for a hundred years it has not yet been determined that such a compound exists?

A. Well, I will—

Q. Further than you said in your answer.

A. I am frank to say that I started from zero,—

Q. I see:

A. — on this.

Q. There is one thing that troubles me, it is just a little departure from the line of questioning that was going on now. I gathered from your testimony that Pb_2O if it exists is an exceedingly fugitive compound. I assume I am right in that?

A. At elevated temperatures and in the presence of oxidizing materials.

Q. Yes. Would you care to assign to those temperatures some order, or attempt to? I don't want specific Fahrenheit degrees, but approximately.

A. I can only mention some actual experiments, that is, the date of actual experiments, for example, 310 degrees centigrade is the—certain heat, of course, is required to decompose, let us say, lead oxalate, now, 310 degrees very, very sensitively is the temperature at which an optimum amount of this compound is formed, 311, or 12, even 15, 315 degrees immediately, instantly lowers, from our own experiments, the quantity which we found. Of course, lower temperatures than 310 degrees centigrade does not permit complete decomposition of the lead oxalate.

Q. Then you trouble me even more than I thought that I was troubled, if it is a fugitive compound, only about 310 degrees centigrade, I am wondering why the Shimadzu product could not and should not have in it the ninety-three to ninety-seven per cent. Pb_2O, if it was formed in the mill.

A. It is, it is fugitive at, dissociates at lower temperatures than 310. I am simply quoting one experiment—

Q. Yes.

A. — that was—at 100 degrees or 150 degrees below that it is still dissociated easily.

Q. Then I am wondering, on the other hand, how it could be possible, since it is so fugitive, for you to say that there can be even in the Shimadzu process any such percentage at any moment of ninety-three to ninety-seven per cent., or even anywhere in that order of socalled Pb_2O in the mill.

A. What we mean, what is indicated by that statement is this, that ninety-three per cent., or ninety per cent. of the product which is produced goes through a suboxide stage, if we simply integrate throughout all the balls and through all the mill, and all that sort of thing.

Q. Then you do not mean, as I understood you to mean, that at any given moment in the mill ninety-three per cent. of the material in there is in the suboxide state?

A. Ninety-three per cent. of suboxide as such is not there, it is going through that stage.

Q. I misunderstood your testimony.

A. Yes.

Q. Then there is another thing about which I have some question, Dr. Clark, and that is, if I understand you aright, you measured only the lead in your—in the centrifuge product, so far as you have told me you did nothing with the residue. Am I right?

A. That has not yet been done, no, sir.

Q. Then how, Dr. Clark, can you assign to your centrifuge product any oxygen at all?

A. For the very good reason, it seems to me, that when this substance is heated in vacuum it very distinctly forms metallic lead and PbO, both of which can be seen and identified.

Q. And then you measured the proportions of that?

A. That has not been done quantitatively.

Q. So that would be another test—

A. It will.

Q. — that will be essential to a sound conclusion?

A. Absolutely, there should be, of course, a ratio of one to one.

Q. Do you base any of your conclusions which you have told us here with respect to your centrifuge product upon the intensity of your diffraction lines?

A. You mean the amount of material in the mixture, or what? It has been—

Q. Well, I wonder if my term "intensity of diffraction lines" means anything. I wonder if I am using that properly.

A. We have used the intensity of the diffraction lines, of course, in these mixtures, in these microphotometer curves, to indicate the approximate composition of any mixture. Now, the intensities of these lines are characteristic, of course, not only of the quantity of material, but there is a certain type or a certain distribution of intensities in the whole pattern, from one line to the other, which characterizes. In other words, some atomic planes, or molecular planes are more thickly populated, for example, and produce by interference of secondary X-rays a more intense line than other planes will.

Q. If I may get a free lecture on one phase of this X-ray experiment, may I ask this, whether there are not primarily two things involved in your diffraction pattern, one, your lines, second, the intensity of those lines?

A. The intensity of the line when you come to a final, unique analysis in terms of space groups, exact atomic positions, that is the method, the intensities are utilized, that is, rough, roughing, roughed values

of intensities are utilized to place exactly in space oxygen atoms and lead atoms and things of that kind.

Q. That is, intensity?

A. Intensity.

Q. Well, then, the intensity of your diffraction lines, does or does it not play an important part in the conclusion?

A. It does play a part.

Q. Would you mind telling me, Doctor, please, what conditions affected diffracting power of a powdered crystal?

A. Well, I am not sure I know just what you mean. Of course, the diffracting power of a crystal—

Q. Well,—

A. — depends upon its structure.

Q. Well, a crystal that is found in a powder of the minute size of that here in question.

A. There are some, what we call extinction effects, effects, distinct effects upon the intensities observed in a powder spectogram.

Q. And they are—

A. Well, we may have—we may have effects, in order finally, in order finally to analyze the situation we must know the laws of reflection by imperfect crystals, because most of these crystals are imperfect, the laws of reflection by imperfect crystals of X-ray waves; we must know what we call the structure factor. There are corrections introduced for the calculation of an absolute intensity for structure factor depending upon temperature, polarization, overlapping of lines, involving, of course, always the fact that we may have a fairly constant, not exactly constant, because it isn't a linear line, but a curve, atomatic structure affected, due to any one particular

kind of atom. That is a highly technical subject, of course, but one which unique analysis must be understood and calculations must be made. Those calulations are made nowadays primarily upon the basis of Fourier analysis.

Q. What kind of analysis?

A. Mathematical Fourier series analysis.

Q. Oh, yes, yes. I was wondering whether particle size is a condition which might affect in some measure the diffracting power of a crystal found in such powder as that we are dealing with here.

A. Yes, there is an effect, a differential effect upon different lines, not only that, not only the particle size, but the particle shape, particle orientation.

Q. Study of strain, for instance?

A. Study of strain, yes.

Q. What affects the relative blackness of two lines on a photograph?

A. Well, that question has many answers, whether you refer to laws of photographic blackening, their logarithmic darkening, or what laws.

Q. Well, I am just wondering what it is, that is my—I am not referring to any specific thing, but we get lines on Exhibit 21, or on the photograms, diffraction patterns, which are shown here, and some lines, as I take it, are blacker than others. It is not so well shown there as it would be on the—

A. Negative.

Q. On the negative.

A. Yes, that is right.

Q. Have you some of those negatives here?

(A negative was shown to the Court.)

Mr. Morris: You can see some of those lines.

By Mr. Morris:

Q. What causes some of those lines to be blacker than others, and what affects the relative blackness of the two lines on such a film?

A. The structure of the crystal, of course, the arrangement of planes, the number of atoms upon the planes, as I said, the intensity, the intensity roughly measured by blackening is a function of all of these things.

Q. That is, the intensity of your diffraction beam would affect the relative blackness,—

A. Yes.

Q. — or the blackness of your line?

A. Yes, that would affect, that is, the intensity of the X-ray beam with respect to, also, the time of exposure.

Q. The time of exposure; were all your films exposed for the same length of time?

A. Essentially the same, one hour.

Q. One hour in your new device?

A. Yes.

Q. Now, I didn't get, Dr. Clark, exactly what you meant by "essentially", you mean there is a possible time error of a minute, or something like that?

A. Well, I simply refer—I was just thinking of the entire composite of all experiments. In any comparative studies, of course, the time is very accurately kept to the same time, one hour.

Q. And all these that are shown on Exhibit 21 were, within some minor degree of error, one hour?

A. Yes.

Q. Photographic films of the same character?

A. Exactly.

Q. Developed under the same conditions?

A. Exactly the same conditions.

Q. Identical conditions?

A. Same temperatures, same length of time in the developer.

THE COURT: I think we will recess for ten minutes.

(Recess at 3.45 o'clock P. M.)

AFTER RECESS.

THE COURT: Judge, do you think you can conclude your cross-examination this afternoon?

MR. MORRIS: I have concluded, if Your Honor please.

GEORGE L. CLARK, recalled.

Re-direct-examination.

BY MR. WHITCOMB:

Q. Dr. Clark, when we started in these processes, you started with pure lead?

THE COURT: Started what?

MR. WHITCOMB: With the little lumps, themselves.

THE COURT: Oh, you mean the process of the pattern?

MR. WHITCOMB: Yes.

THE COURT: Oh, I thought you meant his examination.

THE WITNESS: Yes, metallic lead, pure, at least, in the ordinary sense.

By MR. WHITCOMB:

Q. What degree do you mean?

A. The metallic changes used are very nearly spectroscopically pure. Spectroscopically pure means very small, within the thousandth or ten-thousandth per cent.

Q. Then you use air?

A. Use air.

Q. What about that in connection with other than when you know you are dealing with?

A. I don't quite understand you.

Q. Do you know all the elements to the nth degree of accuracy as to what the air constituencies are, such as oxygen, hydrogen?

A. It is originally nitrogen and a few minute amounts of the rare gases of the atmosphere: possibly a little humidity, carbon dioxide and whatever is in the air.

Q. Then with these processes you started with reasonably known substance?

A. Exactly.

Q. Is that what you mean, you used that as a part in making the conclusions you have made on behalf of the plaintiffs in this case?

A. Yes. Lead and oxygen are the two things which react to each other.

Q. Then when you have made these X-ray examinations which you made on a certain number of examinations of samples, a large number of those, up until you used the centrifuge machine, and then several of those, and your conclusion was you found lead suboxide?

A. That is the conclusion, yes, sir.

Q. These added things, these further tests that

you made, desire to make, would they in any way affect your conclusion as to the existence of the suboxide?

A. Of course, I believe in the existence of suboxide upon the basis of the experiments we have performed so far. It is simply for scientific purposes; it is, of course, very desirable to proceed in testing this material by these other methods which we have not had. Unfortunately for the purposes of our testimony, this centrifuge and these other experiments have been so recent that they simply could not be completed.

Q. Then is there any doubt in your mind about the existence of this?

A. I have no doubt myself.

Q. Do you feel just as positive now as you did in your direct-examination?

A. Yes, that is a feeling I have, that suboxide is formed on the basis of the information that I have myself.

MR. WHITCOMB: That is all.

(Adjourned until Monday, September 30, 1933, at eleven o'clock A. M.)

GEORGE LANE KYLE was called as a witness on behalf of plaintiffs, and having been first duly sworn, testified as follows:

Direct-examination.

By MR. WHITCOMB:

I am from Niagara Falls, New York. My busi-

ness is electrical engineer of the USL Battery Corporation, Niagara Falls. I have been connected with that company since 1915 in the capacity of electrical engineer in charge of the battery testing laboratories, research. Broadly, the business of the USL Corporation is that of manufacturer of storage batteries for all purposes, amongst others, for automobiles. Some large manufacturers which are users of original equipment are the Ford Motor Company, Nash, Auburn, and several others. The annual output is approximately a million and a half batteries for automotive purposes in normal times. As to my specific duties, I am in charge of the testing laboratories. Directly under my control is the testing of all the batteries in the plant at Niagara Falls, that is completed batteries.

Our storage batteries are usually sold under specifications of the original car manufacturer. We have to test the batteries to meet these specifications. I am acquainted with the process of manufacture of a storage battery and with the materials. At USL, we start with lead powder, oxygenated lead powder. That is carried through to what we call the mixing department. In the mixing operation, the powder is put into a large mixer, which is similar to a dough mixer, and by the addition of certain other items, the paste is made into a consistency to be used in the grids of the plate. The powder is mixed with liquid to get a paste. The material is then pasted into the grid, which is the structure of the plate itself. This is done on a pasting machine. (The witness here produced sample grids.) The lattice grid work which you see in the horizontal and vertical fine wires is the grid. The material that has the grayish color there is the paste. That is applied on the pasting machine to one of those grids, separated

at that time. In the pasting machines, the paste is applied into the interstices between the wires on the grid. Then the plate comes off the end of the pasting machine and is then ready for the drying operation or any other process that we might designate, so that it can be handled for its forming process or into the burning of the group itself. The group is the series of plates that are burned together by a strap. The number of plates determines the capacity of the battery. By "burned together", I mean that the plates are placed in a rack with their proper spacing, with the proper post strap, and by a lead-burning operation, the strap is burned across the top to make the electrical connection between the grid structure and the post strap. That is just a technical term, to connect the lug to the several plates. The group that I have here is the negative group. There is the positive group, which is the opposite polarity, which is burned in the same manner.

(Counsel for plaintiffs thereupon offered in evidence the negative group produced by the witness, which was received in evidence and marked Plaintiffs' Exhibit No. 32. Counsel also offered in evidence the positive plates produced by the witness, which were received in evidence and marked Plaintiffs' Exhibit No. 33.)

After the positive and negative groups are burned, that is, by the lead welding operation of the post strap, they are nested together with the positive plate between two of the negative plates, and placed between the plates of opposite polarity is a separator. (The witness here produced a separator.) It may be, as it is in this case, wood, to form the insulator between the positive and the negative plate. This particular sample is in a dry from. This particular

group of positive and negative plates requires a number of separators, but not in a treated condition.

(Counsel for plaintiffs thereupon offered in evidence as a group the separators for this cell, which were received in evidence and marked Plaintiffs' Exhibit No. 34.)

That group is then placed in its respective container and assembled with the covers and links or connecting straps are burned in position for any desired voltage that is required. There are three sells in that box. That is the popular form of automotive battery, which requires six volts, two volts to a cell.

(Counsel for plaintiffs thereupon offered in evidence the remainder of the battery as a unit, which was received in evidence and marked Plaintiffs' Exhibit No. 35.)

I stated that we started with oxygenated lead powder of some kind. USL has a mill operated under the Shimadzu patents. They have had that mill since about 1928. Before that, we purchased oxides; that is, powder in the form of an oxide. We call it oxides in the purchased material. It is the powder that we use for the mix in the mixer that corresponds to a dough mixer. I can best compare the powders, the oxides, we purchased with those that we are making in the mill by the results of our tests in the laboratory. I have some representing results when we used the purchased oxides. (The witness here produced the tests.) I have here curve 5087, dated October 30, 1930. It is a typical curve of a battery made with purchased oxides on the so-called USL life test. At that particular time in our laboratory we were comparing the batteries on a life test, which

consists of a charge and discharge periodically until the battery shows a predetermined capacity, at which point we examine it for failure. By predetermined capacity, I mean a lack of capacity. It is a comparative point at which we tear down all batteries for examination. We run it through these cycles. At the same time that we have a battery in the laboratory on this test, we place a battery in a service car, and compare the number of cycles with the months of service that is rendered in the field. This particular curve shows 130 cycles of life. At that point, we tore the battery down for examination. That is the curve.

(Counsel for plaintiffs thereupon offered in evidence the sheet produced by the witness, showing curve 5087, dated October 30, 1930, which was received in evidence and marked Plaintiffs' Exhibit No. 36.)

The battery will give service after that point, but that is the point at which we examine the batteries, so that we have them on the same basis for comparative purposes. This chart here is an examination of the battery at this point. That tells us the actual life cycles of the battery. From a comparison between this test and the field test and service conditions, we can tell how many cycles represent so much time in service. Every one of the manufacturers that we have supplied have specifications of their own as regards the life. There are slight variations between companies as to their life tests. This is our standard USL life test. We think that this is the best one, coupled with the field data that I have just mentioned, for determining how long a battery will last in the automobile.

(Counsel for plaintiffs thereupon offered in evidence the auxiliary test sheet entitled "Condition at End of Life Test, Dated 2-17-31", which was received in evidence and marked Plaintiffs' Exhibit No. 37.)

That sheet shows us the condition of shedding of the positive material, the condition of the negative plates, the condition of the sediment space, the condition of the separators. In the examination of the battery after we removed the three cells, after it had been on test, the positive group was carefully examined and the items shown on the positive plates were enumerated to show the condition of those plates. Thirty per cent. of the material was gone, that is, thirty per cent. of the lead paste has been eaten off "The upper quarter bare—no. Lower quarter bare—no. Bare in spots—yes—streaks." For a comparable sheet for a battery made with powder that came from the mills at the USL plant itself, I have curve No. 3612, together with a letter of October 14, which shows the first production formula that was put into our plant.

THE COURT: Well, may I ask, at this point, I suppose the purpose of all this is to show that the process which they say is the process of the patent affected a great improvement—

MR. WHITCOMB: Yes.

THE COURT: — in the material?

MR. WHITCOMB: Yes.

THE COURT: Well, now, the first question I have in mind is whether that is a disputed fact, and the second question is, how can we tell what material was being used before, where they got it from.—

MR. WHITCOMB: Well, he can explain.

THE COURT: — and how they were to know they were not getting an inferior material.

MR. WHITCOMB: Well, I think the witness will testify that they were raising the standards of their required specifications when they were purchasing—

THE COURT: Well, all right.

MR. WHITCOMB: — right along.

THE COURT: Yes.

MR. WHITCOMB: And then they shifted over to this material.

THE COURT: Well, all right, I suppose you will—

MR. WHITCOMB: Perhaps I overlooked that.

By MR. WHITCOMB:

Q. By the way, what are the conditions, what specifications did you insist upon, if any, in connection with the oxides when you purchased them? Give the Court some idea of that.

The witness, resuming, testified: For the best grade of oxides that was purchased at that time there were set specifications, in regard to the minimum amount of impurities allowed. Impurity was one of the important factors. They bought it from the Eagle Picher Lead Company, who are standard manufacturers of oxides. We bought these oxides in the form of a powder. Ordinary yellow and ordinary red oxide powder. They were made by furnace process, that is molten lead process, which is an entirely different process. We bought from a number

of different concerns. That was the standard practice for years up until the time we got the Shimadzu mill.

Referring to the sheet just produced, No. 3612, there are three separate tests of three separate batches, 180, 212 and 240 cycles.

THE COURT: As compared with 130—

MR. WHITCOMB: Yes.

THE COURT: — of the old.

THE WITNESS: Yes, sir.

The letter that was produced in connection with the sheet is from the assistant chemist, Mr. G. J. Monnin, to myself. It is an inter-departmental letter, which I got out of my files. It shows that this curve 3612 was used in production.

(The witness here read the letter into the record as follows:

"Mr. Reid has turned over to me blue-prints 3612, 3613, 3614, and 3615 which you submitted to him, and which represent life tests on various mixes of black oxides.

"We are now using in production the formula used in batch 2, represented by curve 3612. The formulae represented by the other curves have been discarded.

/s/ J. G. Monnin
Assistant Chemist."

(Counsel for plaintiffs thereupon offered in evidence USL Battery Corporation Test Sheet No. 3612, dated 10-1-30, produced by the witness, which was received in evidence and marked Plaintiffs' Exhibit No. 38.)

The witness, resuming, testified: These were typical production tests. They were not selected for the purpose of showing particularly good or particularly bad results.

(Counsel for plaintiffs thereupon offered in evidence as Plaintiffs' Exhibit No. 37(sic) the auxiliary sheet, No. 5087-1.)

The life curves show a higher number of cycles in the batteries manufactured with the product from our mill, as compared with the batteries manufactured from purchased powder. That was one of the reasons why we adopted it as regular production. In my experience and from examination of these batteries after the tests it is quite evident that the fineness of the material has quite a bearing on the life. It gives us a more consistent plate in capacity. We don't find any evidence of cracking in the original manufacturing, in either plate. We found a difference in flaking or cracking of the plates between the old oxides that were used and the Shimadzu mill powders. In the manufacture of the negative plates under the old process, we had considerable shrinkage of the material, which we have not experienced with the present mixture that we use. That resulted in a series of cracks in the material itself. That has a deleterious effect on the negative capacity of the battery. It affects the capacity. That was under the old process, whereas with the new we overcame that difficulty.

With the product from the mill, we have better control of the material. We have specifications, for the lead that we use in the mill, bought under what we call pure lead, but these specifications are much more rigid in regard to minimum quantities of impurities than the old oxides we purchased before

that time. I think that shows up in the performance I have indicated. We found that the material manufactured from the mill has a finer particle than the purchased oxides that we had at that time. It has some coarse as well, but it has the finer, and the finer is still finer than those that were purchased. That has the effect of giving up a more consistent paste for pasting of the plates. That, in turn, results in longer life, we find through our tests, by less shedding of the active material on the positive plates. That less shedding is one of the points brought out in the sheet which showed what happened to the battery after it had failed. The new oxides tend to avoid that to a certain extent, in my opinion. We purchased both red lead and ordinary litharge. There was no metallic lead in the powders we purchased. The powders made in the mill of the USL plant contain finely divided lead particles, lead oxide and suboxide of lead. The operations of the mill itself in the USL plant are not directly under my supervision, but I have been in the department when the mill was being operated. The mill, as placed in the USL factory, is a rotating drum into which are fed small lead pieces. The first installation came from Japan. I have no blue-prints or charts of the mill. We can get them for you. As I said before, we have a rotating drum into which are fed small lead particles at one end and through which a blast of air is blown. The particles that are fed in come off our chipping machine approximately an inch square. The blast of air carries the lead particles through, up into a bag house and into a receiver or collector at the other end. As to the controls or charts which indicate what is going on, I have inspected the charts on the front of the temperature control board. I have never noticed the chart in regard to the air.

They have a control of the air, that is, the pressure. My inspection has been such that I have only noticed the temperature controls. There is a forced draft, however. I have noticed that by going through and the fan blowing through the drum.

When I said that that chart (Plaintiffs' Exhibits 13, 14 and 15) was not a picture of the installation at USL, I meant as to certain design details of the machine itself, that is, from the outer description of the machine.

With respect to the cost of operation of the mill and the finished product against the cost of purchased litharge or lead particles, we have less cost with the present mill product than in purchasing the material from the outside. From my experience with this material, I would not recommend going back to the purchased oxides.

Cross-examination.

By Mr. Morris:

The products manufactured in the mill which I described are better for battery purposes than the old purchased oxides, due to the fineness of the material, which we have experienced through the examination of our batteries on these tests, and the purity of the material and the control we have over the purity of the material. We buy the purest grade of lead on the market for the mill at the present time, so that the reason for greater purity is the greater purity of the product that is put into the mill. They cannot manufacture the same purity. If we had a mill or a furnace to make it by the old process, we could buy just as pure initial that goes into the furnace as we wanted. That would be the same degree of purity. But the finished product that

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we buy in the oxides would not be of the same degree as we get out of our mill. If we were operating the thing from the beginning to end, the item of cost would come in. It would be true that, if we owned both kinds of processes, we could get just as pure a product out of one as the other. Assuming equal purity in the initial charge of lead, the one fact that makes a difference in the two materials is the fineness, the increased fineness of the present product over the fineness of the old.

In our mill, the exterior of the drum is closed. The drum is cylindrical. It is not of the type of the Hardinge mill, that is, a cone shape, but is cylindrical. I am an engineer and have been manufacturing batteries since 1915. (A model of the Hardinge type mill was shown to the witness.) Our mill is not in that form, but is cylindrical, with the intake orifice in one trunion and the exit or discharge orifice in the other trunion. We blow the powder out of our mill. I am not exactly familiar with the operation of the mill, but I would say that we blow it out. If we didn't blow it out, it might be carried out through some mechanical means. It would not run out of our mill by gravity.

Prior to taking a license under the Shimadzu patents, we purchased yellow litharge and red lead. We did not specify to the manufacturer that they should be mixed in certain proportions. We bought them under their terms, designated in that particular.

By The Court:

Q. Pardon me, litharge and what?
A. Ordinary yellow litharge and red lead.
Q. What is the difference?

By Mr. Morris:

Q. You mean Pb_3O_4, or do you mean the tetragonal form of litharge?

A. No, Pb_3O_4.

The Court: Now, wait a minute,—

Mr. Morris: I think I can straighten you out in just a moment.

The Court: All right.

Mr. Morris: Litharge, which is PbO, crystallizes in at least two forms,—

The Court: Yes.

Mr. Morris: — the tetragonal,—

The Court: I remember that.

Mr. Morris: — which is reddish,—

The Court: Yes.

Mr. Morris: — and the yellow, which is orthorhombic.

The Court: These are just the two forms of litharge?

Mr. Morris: This is all litharge.

The Witness: This is the purchased material.

By The Court:

Q. I know, but you spoke of litharge and red lead as though they were different things.

A. They are.

Mr. Whitcomb: They are, there is a third one called red lead. That is Pb_3O_4, another form

THE COURT: It is Pb_3O_4, all right.

MR. MORRIS: What I was asking the witness whether he meant the tetragonal litha[illegible], which is PbO, the same as the yellow litharge, or Pb_3O_4.

THE COURT: He says he means the Pb_3O_4.

MR. MORRIS: I see.

THE COURT: And the other is tetragonal litharge, the red lead you are speaking of is the Pb_3O_4, and the litharge you are speaking of is ordinary tetragonal litharge, is that right?

MR. MORRIS: Orthorhombic.

By THE COURT:

Q. Orthorhombic?
A. Orthorhombic.
Q. That is the yellow?
A. Orthorhombic is the yellow.

THE COURT: All right.

The witness, resuming, testifies: Prior to that, we did not have any free lead in our mixture, nothing except Pb_3O_4 and yellow PbO. I said that in this new mixture we have three ingredients, lead, finely powdered, lead oxide, and lead suboxide. I have been told that through the testimony of Dr. Clark. As to the source of information on which I make the statement that those are the three ingredients, we have determined that there is free lead in the powder itself. We have also determined the oxide of lead, and I take the statement in regard to the suboxide of lead from Dr. Clark. We determined that there was an oxide of lead present in our chemical laboratory. I am not a chemist. The information comes directly

from reports of our chemical laboratory to me. I know that there is such a compound as Pb_2O only through the testimony that has been given here by Dr. Clark.

The tests conducted are of typical production batteries, tests on production batteries taken from our production line. The particular tests referred to this morning in that curve cover one battery. That is, a typical test. That represents a fair average for a number of batteries in results both before and afterwards. In that one particular curve, 3612, if I recall the number right, designates three batteries, that is three different batches. I have said that the test of the old material gave 139 cycles of life. That was an average number of cycles for our old batteries made with the old material. I make that answer from our file referring to a great number of tests. I have examined those for the purpose of answering that question. Some of them ran as high as 155 cycles. I found none of the old powder that ran higher than 155 cycles in the tests that I examined. The tests were selected at random through the file. They were picked out at random from the files, on a fair basis to give a correct average. 3612 covers the three batches, on the first black oxide. This is the first test of black oxide and is lower than we are obtaining at the present time. All the three cycles, 180, 212 and 247, the highest is lower than our average result at the present time. We have some curves of the present batteries if you like to see them. One of them shows 272 cycles and 315. I will describe the details of a life test to which these respective batteries were subjected. In order to work it into laboratory hours, we take a discharge in the morning at eight-thirty until ten-thirty, at 24 g am-

peres, of an ordinary thirteen plate battery, which is rated on this curve as 102 amperes at the twenty-minute rate, of 90 ampere hours at the twenty hour rate; and from ten-thirty to twelve-thirty we charge at 27½ amperes; and from twelve-thirty until three we charge at a lower rate of 6 amperes; and from three o'clock until five, we discharge at 24½ amperes; and from five until eight-thirty next morning we charge again at 4½ amperes. That is merely to obtain two full cycles of discharge per day, which are represented on this curve as life cycles. That is continued from Monday morning until Saturday morning, until the battery shows failure. The fact or factor which determines the finish point of the test is the predetermined point of twelve minutes at the twenty minute rate of discharge. The old oxide plates lasted 130 cycles on that first curve submitted. You can't term the service life a designation of cycles, because you don't get a complete cycle. We do not subject every battery that is sent out to a life test before it goes out. The battery would be gone then. The batteries made under the old specifications at 130 cycles represents the battery that was on test in the laboratory. A comparative battery manufactured at the same time, under the same conditions, was placed in our service car for tests against that curve, and we found that approximately ten cycles represents one month of service in the field. The conditions of this test in comparison with the conditions of the test to which the present batteries are subjected are identically the same. This particular test is conducted on plates of three thirty-seconds of an inch in thickness. Both the 130 cycle test and the present test are identical in regard to thickness of plates. Both rated at 102 amperes.

In making our paste, we use some sulphuric acid and water. The sulphuric acid was diluted as it says in the recitation of the prior art in this patent. We used those same ingredients, that is, the same liquid, dilute sulphuric acid and water, in making our present plates. We didn't use anything else in 1915 and on until we got the Shimadzu license, with the exception that in a negative mix, inert material has been added, but that is for another reason. But so far as mixing of the paste is concerned, we had been using dilute sulphuric acid, or dilute sulphuric acid and water, since 1915. So far as we are concerned here, we used nothing else until we came to the Shimadzu product. There is a difference in the mixing of these same ingredients in order to make the Shimadzu product adaptable. I mean by that the length of time in your different mixing operations. But the same ingredients, dilute sulphuric acid and water, are used. The difference is in the mixing time. We had no free lead in our old product. The Shimadzu product is finer than the old product, as I stated. I do not have with me the dimensions of the powder in the old product. I can get it for you. I have seen the figures as to the dimensions of the powder in our present product, but I don't recall just what they are right now. I have both of those in our chemical laboratory. I did not make any measurements myself. I know about this only through my contact with the chemical laboratory. From things that I have received from our chemical laboratory, I have been advised that there are finer particles in our present product. To what extent they are finer I do not know. There is not such a difference in fineness that can be detected by feeling or looking at it. I will supply you with those figures or

withdraw the statement that one is finer than the other. I never subjected the old product of which we made plates to a test myself to ascertain whether there was the ordinary red lead, Pb_3O_4, and the yellow litharge, and no free lead. All I know about is what I have been advised.

Re-direct-examination.

By Mr. Whitcomb:

In the molten processes the finished product is not as pure as in the Shimadzu process, from the specifications we are furnished. In the furnacing processes, they pick up impurities. They used fifty per cent. Pb_3O_4 in the mix in the old type, in the positive plate only. The negative plate is straight yellow litharge. When you finish up in each case, you have lead peroxide on your positive and spongy lead on negative and finished form plates. That is, in the old method and the new Shimadzu method. In the finished negative plate, metallic lead is called spongy lead. It is just ordinary metallic lead. The significance of the term "spongy" is in the texture of the plate itself. The processing gives it that effect. That result is obtained from the powder in the formation of the plate itself. That breaks down into those two things by the actual current.

Re-cross-examination.

By Mr. Morris:

My personal knowledge as to the impurities in the process of manufacturing the old lead powder which we purchased from 1915 on to 1928, is through the chemical tests in our chemical laboratory. Our chemical tests did not tell us exactly when that im-

purity got into the product. I say that it got in during the process of manufacture and was not in the lead that was used in the manufacture of the lead powder sent to it through hearsay from the men that are in the manufacture themselves. I don't know, except through the process that we have gone through of the tests and all. Our chemical tests do not tell you that it got in during the process of manufacture. We knew it was there and inquiring from the manufacturer of the lead, which we had no control over, he stated that it was in there due to the manufacture. I didn't get the information from the result of our tests in the laboratory.

Re-direct-examination.

By Mr. Whitcomb:

I regard this point about the impurity as a reason why we would use the Shimadzu process in preference to buying the litharge.

William Cooper was called as a witness on behalf of plaintiffs and having been first duly sworn, testified as follows:

Direct-examination.

By Mr. Whitcomb:

I am employed at Niagara Falls with the USL Battery Company. I have been with the Electric Storage Battery Company in Philadelphia. I went to work for them in June 1923 and left there some time in the year 1930. At the time I left I was working in the gray oxide department. They made lead, just

called gray oxide. They have made it by the use of a mill. My duties there were as an operator of one of the mills. I was an operator for seven years. These mills were what is known as Hardinge mills, cyclone and bag, container bags, screen—lead balls were put in the mill. The cyclone drew the air through the mill from an air intake pipe. A fan actually drew the air. The fan was situated on the cyclone. The bags I refer to were situated in a container next to the cyclone and contained six bags for the purpose of catching—with respect to both cyclone and bag containers, the fan was situated on the same platform as the cyclone, that is, between the two. The air inlet pipe was situated on the feed end of the mill. By the feed end I mean the one where the balls are fed into the mill. I mentioned a screen. That is at the discharge end of the mill. The material obtained from the mills was put into drums under the discharge end of the mill. As the cyclone drew the air through the mill, a percentage of dust was deposited in the bag collectors. Under each feed of the cyclone and bag collectors was situated a drum which emptied into a drum. That was not the same drum that the finished product went into first. The size of the drum was the same. The dust or powder would be a very much finer powder. Three drums were situated. We got three different grades of fineness. At the time I left they did not use the three drums for each mill. But sometime prior to that they had used the three drums. Just at the time I left that had an automatic screw conveyor which carried the contents of the cyclone and bag containers back to the discharge drums at the discharge end of the mill. Then we combined the three drums into one drum. When we were using the three drums we would get perhaps one drum of material per shift from the

cyclone and from the bag containers. By shift, I mean eight hours. An average of twenty-four drums went to them from the main exit, that is, we got one drum from the cyclone and one from the bags. That would be two drums from the combined product of the cyclone and the bag containers, twenty-four from the discharge of the mill. The mill rotated (the witness here examined a drawing attached to Dr. Wilson's report, "Plaintiffs' Exhibit 20). That represents generally the type of mill I have been talking about. It shows the Hardinge mill, the cyclone and bag collectors. From 1923 up until the year 1926, the balls were fed into the feed end of the mill by hand. Eighty lead balls of four hundred pounds were discharged from the mill every twenty minutes. There were no changes for a number of years in the operation. When I left they were not still feeding by hand. They had a semi-automatic feed consisting of a ball elevated from a pit to an automatic chain running along the front of the mills which fed the balls into the mill. There was a chute attached in front of each mill into which the balls went, a square open chute. It was open clear up to the inlet of the drum of the mill. Beside the balls there were ball counters in the chute. The ball counters counted the balls as they went into the mill. There wasn't any sliding to interfere with the free passage of the balls at the time of the feeding semi-automatically. The balls being fed at the rate of twenty balls per five minutes over a period of twenty minutes and could hardly have a slide, normally. The balls were three inches in size. Every five minues twenty balls were fed, so that for every twenty minutes there was a total of eighty. I do not know the exact size of the fan of the mills at that time. Air could go in the Hardinge mill

through an inlet tube and also through the chute that I have described. The fan was running continuously while the mill was in operation. I do not know exactly the size of that chute. It was about four inches. The ball had about one inch play. In the cyclone the material that was collected dropped of its own accord down into the conveyor or into the earlier drums that we used. Part of the bag collectors between the bag and the screen shook or collapsed once every hour, or half hour so that considerable of the material that was collected in the bag collectors was shaken down by the shaking of the bags. In the early years, that was done by hand, later automatically the dust inside the drum in the mill would blow out at the feed end of the mill, through the outlet where the balls were fed into the mill. The dust came out of the mill. The mill was then full of dust and lead balls. When the bag shakers operated the effect was to blow some dust out of that end, although the feed was toward the other end. Of course, during the operation of the bag shaking, the fan was shut off. The little conical shaped cone dotted out after the outlet end of the Hardinge mill is a half inch mesh screen called a bell screen. It is cone shaped, the reverse of the picture. It should be arranged with the point towards the mouth of the mill. I can show that arrangement. (The witness here did so.) That little extension up in red is a little shaft that held the screen in place, clamped on the mouth of the mill. I think this drawing shows that particular screen headed the wrong way and it should be reversed.

(Counsel for plaintiffs thereupon offered in evidence a certified copy of the drawing SB 267428-1, which was received in evidence and marked "Plaintiffs' Exhibit 20-A.)

Among other changes on this drawing, I notice that the air intake pipe is an entry entering on the scrap chute of the drawing. As a matter of fact it entered below the mouth of the feed chute. By the scrap chute, I mean this little bucket conveyor. The bucket conveyor was for the purpose of taking up the coarser material that would not pass through the screen back to the feed, to the mouth of the mill.

By The Court:

Q. You mean—oh, I see.

Mr. Whitcomb: The overflow.

The Court: Oh, yes.

This inlet pipe is supposed to go right into the drum and not into that chute. Another change that I would like to note is that the hood on the top of the screen hood was flat. Instead of being conical shape, this way, it wasn't this way at all. This top of the screen hood was flat. The fan was not located as shown on this drawing. The fan was located directly on the cyclone. These changes that I have noted were on the mill when I left in 1930. With respect to the procedure for shutting down a mill, about an hour or two hours from the shut down for the week end, the operators stopped feeding lead balls into the mill, allowing the mill to kind of run down or empty most of the dust in the mill out. The object of that was to attain heat faster inside the mill on starting up again on Monday. That did help to attain heat chiefly because you are not carrying off a heavy load. The revolution of the mill was fourteen R. P. M., that of the fan twenty-eight hundred. I remember an occasion when the mill would start up without anything in it at all. That occasion was on

the installation of new mills in 1926. Another occasion was what is called a burnt mill, where the product in the mill being frozen was dumped entirely. by frozen, I mean that too much heat was obtained in the mill to mill. It could no longer operate as a mill should operate. We dumped the mill by turning the manhole covers down towards the floor, taking them off and letting the produce come out on the floor. Some of it ran out, and if large lumps were in the mill they had to be broken up to get them out. I remember doing this some time after these mills were installed that I just mentioned prior to the time I left. I do not remember the exact date. I believe the last one I remember was in the fall of 1927. After the mill is emptied, it is recharged with new lead balls and part of the lead balls that have been picked out of the stuff dropped out of the mill. Some of it is entered into the mills while stationary. When starting up the mill in the fall of 1927 after it had been dumped, all the good stuff was taken and brought up to the drum, all of the lead balls that could be picked out of the stuff that was dumped out of the mill was put back in the mill and combined with the new lead balls and entered into the mill through the chute or through the manhole cover by throwing them in by hand. That was before the rotating was started. Then the manhole cover was put on the mill again and the mill was started rotating and the remainder of the load consisting of approximately twenty thousand pounds was fed into the mill. That took a period of approximately two and a half hours or three hours, to fill the load into the mill. Very little air was turned on. To keep the dust from shooting out of the feed end of the mill, there is little air. By the end of two and a half hours to three hours a

load is in the mill. Then you wait until the mill attains the temperature of about three hundred and forty degrees of heat. No material is discharged until there is a full load. After a full load some material is discharged. That material is not used. It is a black color, and is called by the operators, scrap. It is just set aside and returned into the mills again. Depending on the mill, it takes perhaps one shift, eight hours, to get up the temperature I mentioned after there is a full load and the mill is started. Depending on the temperature reaching its height, you probably would get material that is good in six hours, seven hours, on an average. The temperature was three hundred and forty degrees. It takes about a shift, or eight hours or so, to dump a mill and start it anew.

I have had occasion to look in to one of these mills when it was rotating. That is done by opening the door in front of the discharge hood. It showed a screen with the produce revolving upon the screen. When the door was opened, that opened it to the air. The fan was still operating. It did not have a similar effect I mentioned before of dust coming out of the feed end of the mill. The door was on the front.

THE COURT: Where is he putting it? Where is it?

MR. WHITCOMB: It is way on this end of the screen.

THE COURT: Cylindrical screen?

MR. WHITCOMB: Yes. The door is on this part here (indicating).

THE COURT: All right.

That was open to the air at that point immedi-

ately on opening the door. It is a large opening as shown. I do not know the exact size of the opening of the discharge where the little conical screen is. The conical screen is smaller than this as shown on this drawing but larger in mesh. It is smaller in size as indicated there. You could see inside one of these Hardinge mills by taking the manhole cover off the mill while it was stationary. While it was running you could open the feed door on the front of the mill and go around the feed end of the mill. There was a small peep hole situated at the feed plate of the mill from which you could remove the plug and peep through the mill, having someone hold an electric light bulb in the other end. Without that procedure I never had occasion to look through. The door was made of sheet metal. They always have sheet metal. There is no way of visually looking through a drum in any of those places. At one time they had a small glass part of this same door. You could not see through that after the mill was in operation because too much dust clouded the glass.

While I was employed there they had ten mills of this kind. While I was employed there they were all exactly arranged like this. They had one other kind used for experimental purposes set aside from these mills. It differed from these in the respect that it was operated without a screen. That is, the cylindrical screen was not used. There was no discharge. They had the cyclone and bag collectors. Any material discharged from the mill all came out through one or the other cyclone or bag collector. I operated that mill. The material was disposed of by usage.

During this period of stopping on Saturday and starting on Monday, on starting upon Monday probably the first few drums coming off the mill would be good produce, and the following drums maybe five or

six in number would be too low in oxidation to use, owing to the new feed and temperature being raised in the mill. That would be a period of about six hours from starting the mill operating normally. On Sunday the mill would be entirely shut down. There would be no rotation, no air, no temperature. It would be just dead and cold. We took off maybe the first two drums of good material. That would be eight hundred pounds. That would be forty minutes. You would have then six drums of bad material in about two hours more. Then it would be up to normal after that. The bad material was refed back into the mill. There is an indication of a water cooling arrangement here. The mill itself is enclosed in a shell. You do not see the water when just looking at a mill as it is at any operating period. There is no water around the mill anywhere else. I have seen water drop into the material. It smoulders, that is, burns. I have noticed that often. It happened when some empty drums would be lying under the mill, with perhaps a little oxide at the bottom, and these hoods around the mills were not water proof and the drops of water would fall into the drums without lids, or with just a little material left in, and you had moisture and change in color. That was smouldering of the oxide in the drums.

During the years the mills were hand operated or hand fed, we used at different times wooden plugs for the purpose of shutting off the balls from going into the mill or shutting off the pellet chute. This was not all the time while we had hand feeding. Occasionally the operator used his own discretion, whether he would put the plug in the hole or not. While the mills were being fed at the rate of twenty balls every five minutes, with the semi-automatic feed, it was almost impossible to keep a plug at the feed

end of the mill all the time. We did not have any plug that I remember. During that time, the air could enter there as well as through the regular air inlet pipes. No moisture or water was put in the air as it entered either of these tubes. I do not know what the pivot tube readings were. I don't know the scale calculations. They had some pivot tube readings there on some scale.

Cross-examination.

By Mr. Morris:

I am thirty-nine years old. I have been with the USL nine weeks. I went with the USL in July or August of this year. My position with the USL is taking lead weights in the pasting department. I made my application for employment with USL through their regular channels, stating what work I had done. I gave USL this information at the time I made my application. That is, before I was employed, I gave them the information of the type of work I had been doing. When I applied for the position at the USL I described the process of my occupation then. I did not give them this information about shutting down the plant over Sundays and shutting down the mill and starting it up again and that sort of thing at the time I made my application. I am giving it now. I did not give it to them at any time before this.

Q. As I understand you, then, you were never asked for any detailed information by USL or any of its officers or employees, the information you have given on the stand today must come to them for the first time?

A. As far as I know, yes, sir.

Q. They didn't even know that the screen had been reversed at the discharge end of the mill--

A. No, sir.

Q. —until you told them today?

A. No, sir.

Q. They didn't know that you sometimes used a wooden plug when the operation was being—the mill was being fed by hand until you told them today?

A. No, sir.

Q. Are you under subpoena?

A. No, sir.

Q. How do you happen to come down?

A. Voluntarily.

Q. Voluntarily. Who asked you to come down?

A. Mr. Whitcomb.

Q. Mr. Whitcomb?

By The Court:

Q. Let us get this straight, if I may. I don't know whether you are doing yourself justice, or whether you are saying what you intend, when you speak of the present. I have a different idea. Did you give anybody this information before you gave it on the stand today?

A. No, sir.

Q. Didn't tell anybody?

A. No, sir.

Mr. Morris: Will Your Honor ask some more questions along that line, because either the witness—

The Court: No, I don't believe it, that's all there is to that.

Mr. Morris: Well, of course, I don't either, but I wondered whether—

THE COURT: I don't know whether he is doing himself justice or not. You can't tell me that you were brought down here and nobody had the slightest idea what you were going to testify to in a case as important as this, and you simply went on the stand and gave the information you did for the first time and nobody knew what you were going to say.

THE WITNESS: I had explained the type of operation I had been working at, sir.

By THE COURT:

Q. I want to give you a chance to explain that. We have been through this many, many times, we know cases are not tried that way, that's all there is to that.

By MR. MORRIS:

Q. Is there anything else you want to add in answer to either the court's question or mine, as to when you made—told any of the employees or officers of USL what you have told us, or whether you told counsel for plaintiffs?

A. During my application for the employment, I was asked what type of mills I had been employed on, and I explained it to the best of my ability, like I am doing now.

By THE COURT:

Q. I mean, now, the specific information that is being asked for, the specific fact, for instance, that that mill was regularly or frequently shut down and remained shut down over the week-end and was started up again?

A. No, sir, I did not explain anything of that.

By Mr. Morris:

Q. And you never—I am sorry.

The Court: Go ahead, that's all right.

By Mr. Morris:

Q. You have never explained that to anybody connected with USL or the plaintiffs in this case until you explained it to Mr. Whitcomb—

A. Today.

Q. —this afternoon?

A. Yes, shutting down and starting the mill again.

Q. You had never mentioned it to anybody before?

A. No, sir.

Q. Not even to Mr. Whitcomb or to any of his associates?

A. No, sir.

Q. Or the USL or any of their officers or employees?

A. I explained the mode of operation.

Q. You explained the mode of operation?

A. Yes, sir.

Q. When and to whom?

A. To the man to whom I made application for the position, sir.

Q. What did he ask you?

A. Asked me what type of mill I had operated.

Q. What did you tell him?

A. I explained it was the Hardinge type of mill.

Q. What did he say?

A. Nothing.

Q. That is where you stopped?

A. No, sir.

Q. And you didn't tell him any more?

A. As I said, I told him the type of operation, sir.

Q. But, won't you tell me, not state generally what you told him, but won't you tell me just exactly what you told him? Assume that I am the man who asked you what type of operation you were familiar with, or had been using then, or had used with the Electric Storage Battery. Now, then, give me your answer as if I were the man who asked you that at the time of your application?

A. I applied for employment, sir, and I stated in my application to the man that I had been an operator on a Hardinge mill and explained the operation as he asked me.

Q. What did he ask you and what did you say?

A. How it operated.

Q. And won't you tell me now what you told him? Don't say generally but just the words that you used for him, as far as you can remember.

A. I told him the type of mill, cyclone, bag collectors, it was loaded with lead balls which were cascaded in the mill, erupted from the discharge end of the mill, sir.

Q. Then what did he ask you?

A. I don't remember what he asked me then, sir.

Q. When did you first know that you were coming down here to testify?

A. A few days ago, sir.

Q. Who asked you to come?

A. Mr. Whitcomb.

Q. And where were you when Mr. Whitcomb asked you to?

A. USL Battery Corporation.

Q. How did he find you?

A. Through the corporation, sir.

Q. And you didn't talk to Mr. Whitcomb before or since that time until this afternoon?

A. Until this afternoon, no, sir.

Q. Let me put it this way, that if you have anything else to add as to whether you have talked to the USL people or to Mr. Whitcomb or any of his associates or any officers of the Northeastern Engineering Company, one of the plaintiffs in this suit, or Mr. Shimadzu, or any of his associates, I would be glad if you would tell it now, because I have no further specific questions to ask you about that.

A. Why, no, I don't know the officers of these organizations you speak of.

We first got black powder when the mill was started up on Monday mornings after turning the load in the mill. We did not get black powder in any mill being operated for the first time. I began working with the Electric Storage Battery in June, 1923. The mills were in operation when I went there. In those days, we were working seven days a week. So that the first time that the mill ever shut down on Sunday was approximately 1928, 1929 or 1930. From 1923 up until 1927, there was a shut down of some mills at the Electric Storage Battery plant over a week end, depending on the production that was needed. I do not know the exact time that any mill of the Electric Storage Battery plant was shut down over the week end after I became an employee of the Electric Storage Battery in the summer of 1923. For about two years after I came there we ran the mills regularly over a period of seven days. Then about 1925, we started to have Sunday shut downs on some of the mills. When we started up Monday mornings, we did not get black powder out of the mills that had been in operation the week before. There is a certain amount of good powder left in those mills when you

shut down. After the first three or four drums we did not get exactly black powder. I would only get black powder out of one new mill that was being operated for the first time. The powder we got after the first three or four drums were taken off, was low in oxidation and was gray, dark color or blackish, darker than the other powder that we had been getting. It was substantially darker. I have seen crushed slate. In answer to the Court's question, I fix the year 1925 as the first time after I went to the Electric Storage Battery that any mill was shut down on Sunday. 1925 was ten years ago. I have no difficulty in fixing 1925 rather than 1923 or 1924 or 26 or 27 as the date in which a mill was first shut down after I went to Electric Storage Battery Company.

By THE COURT:

Q. He wants to know whether you are sure that that was the year that they started to have shut-downs?

A. No, sir.

Q. You are not sure?

A. No, sir, I am not absolutely sure.

(The witness resuming testified):

These mills are operated on a three shift basis, consisting of one shift going on from seven until three in the afternoon, seven in the morning until three, one shift from three o'clock until eleven in the evening, and another shift from eleven in the evening until seven the following morning and the last shift operating on Saturday night would shut down Sunday morning until the first shift came on Monday morning. That was in vogue all the time. If the mill had been operating the previous week up until the shut down, two or three drums that came off first

on Monday morning were O. K. The color had not changed any in that mill that I can remember. There was no difference in the next four or five or six drums in 1923, 24 or 25 from those first one or two drums that I have mentioned. The color always remained about the same. The color changes after you obtain a heat temperature on the mill and the air is put in the mill. The first time I knew of a mill being shut down for a sufficient length of time to enable the mill to cool off, to get down to room temperature, was in 1923, on a Sunday. It was shut down over Sunday. The first one or two drums you get on starting it out on Monday morning were more or less like this tube of powder (indicated by counsel), substantially like that. (The tube of powder referred to by counsel was run 21, mill number 1, time 1.30 P. M. finished product of May 25, 1934, marked P-22-C). After the run of one or two drums, two or three drums had been taken off, the color of the product would change a little. It would not be as dark as the plate marked P-32 for example (indicated by counsel). It would not be exactly slate color, it would be a little lighter than that. It would be a little darker than the exhibit that was shown me. That was a lower oxidation. We tested each and every one of those drums that came off of those mills. And perhaps the oxidation would drop as low as forty-five per cent, that is forty-five per cent in specific gravity after being tested with acetic acid. I am not qualified to state whether the rest would be metallic lead. But the percentage test would show an oxidation content of less than forty-five per cent. Normal is between sixty-five per cent to sixty-eight per cent. That began in 1923. In 1926 they had installed some of the new mills, which used large balls. In 1925 we had used the two inch balls. We stopped doing that in 1926. In 1926 we used the

three inch balls. I don't remember the month when we began to do that. We did not make any other change in 1926 as to the product. Late in 1926 we experimented with the elevated semi-automatic feed conveyers. They introduced the semi-automatic feed in 1926. The freezing of the mills would happen occasionally at almost any time, owing to the heat temperature of the mill going up above normal capacity. Normal capacity was three hundred and forty degrees. I was there until 1930. I began in 1923. I had several experiences of burning the produce in the mills. I cannot fix the times for that. I cannot say the exact time for any of those. 1927 I believe was the last time I had a mill freeze. While I was employed there the screen was always the reverse of what is shown in this picture. The point of the cone was pointed outwardly instead of inwardly. The discharge from the cyclone was to a separate drum some part of the time I was there. I don't know the exact time when that was switched so as to provide a conveyer from the bottom of the cyclone chamber back to the discharge drum from the main machine. I don't know the exact time when they stopped using the wooden plug either. I do know that somebody used a separate drum for the bag collector chamber. I think the year was 1928. 1928 was the year when they stopped using the separate drums below the bag collector. They stopped using it beneath the cyclone the same year. I fix that from experience. I fix that the same way I fix 1927 for the last freezing up of the mill. I don't know the exact day and month of 1927 when that occurred. Those dates are hard to remember. It was in the latter part of the year 1927. I fix it as the latter part of the year because that is how I remember it. It wasn't 1928 instead of 1927 as I remember. I am quite clear that that is not the fact.

It could not have been 1926, but other cases could have happened of the same thing in 1926. The suggestion that it was in May, 1927 would not help refresh my recollection. These occurrences were not exactly frequent, but such things happen so often you cannot recall the dates exactly. I believe it was later in 1927 than May.

Q. And you have told that to whom prior to telling it on the stand today?

A. No one, sir.

MR. MORRIS: That is all.

THE COURT: Now, I do not want to do this witness any injustice, but he has given me the impression, somehow, that he has been just brought down here as we say, cold, nobody knew what he was going to testify to. He hasn't talked over the subject of his testimony with anybody. If that is the impression he wants to leave with me, it is all right.

MR. WHITCOMB: Could I ask some questions which might—

THE COURT: Yes, I would like to know what the situation is. Not that it makes a great deal of difference, but it just means to me that it is not entirely credible.

MR. WHITCOMB: No.

THE COURT: These cases are not prepared that way.

Re-direct-examination.

By MR. WHITCOMB:

Q. Last night at the hotel I met you and Mr. Nagle, is that right?

A. Yes, sir.

Q. Who were in the room?

A. At first, you were, sir.

Q. And Mr. Nagle?

A. Yes, sir.

Q. And yourself?

A. Yes, sir.

Q. And later who was there?

A. Mr. Shaffer, sir.

Q. And before Mr. Shaffer came, who did most of the talking, would you say?

A. Mr. Nagle.

Q. Mr. Nagle and I—

A. Yes, sir.

Q. —did I do any talking?

A. A little.

Q. Did he talk about some of these things you have been talking about now?

A. Yes, sir.

Q. Quite fully?

A. As fully as I have tried to explain them, sir.

Q. Did you say much to me?

A. No, sir.

Q. Then what happened?

A. Mr. Nagle went down to Philadelphia.

Q. But Mr. Shaffer came down in the meantime?

A. Yes, sir, Mr. Shaffer came down also.

Q. With whom did he talk?

A. Mr. Nagle.

Q. Did he talk with Mr. Nagle as much as he had with you or not?

A. More with him than me.

Q. These details you are talking about, Mr. Nagle talked about quite fully, is that right?

A. Freely, yes, sir.

Q. Is that what you had in mind when you testified?

A. Yes, sir.

Q. Before that, when you made your application with USL, you said before that you talked about answering questions broadly about this mill. Is that your testimony?

A. Yes, sir.

Q. But these details you are talking about came out when you were talking with Mr. Nagle last night, is that correct?

A. Yes, sir.

Q. Before that did you mention anything about the cone at the outlet of the mill?

A. I might have mentioned in my application what the mill consisted of.

Q. Did you say which direction that cone was pointed?

A. I said the cone was pointed outward at the mouth of the mill.

Q. You said that last night, I know, but did you say that before that?

A. No, sir, no one asked me.

By The Court:

Q. Did you discuss these Sunday shutdowns and the character of the product you got after the shutdown? Did you discuss that?

A. Yes, we were talking about that fact?

Q. I certainly thought so. It was not the impression you left with me on your direct-examination.

By Mr. Whitcomb:

Q. We want you to tell it fully and explain it to the judge. We are just as much concerned in seeing—oh, I think I might as well say what I am driving at—

THE COURT: I shouldn't be at all surprised. Witnesses get on the stand, they seem to think it is a criminal offense to give information to their own counsel or counsel for the party that calls them before the case; they always put themselves in a bad light that way. Everybody knows that competent lawyers in an important case are not putting witnesses on the stand unless they do know pretty well what he is going to say. It just is not done. The witness tells me he has never told anybody what he is going to testify to. It is certainly not usual or a likely thing. There is no harm in talking the case over with counsel. No harm at all in giving counsel the information on what you are going to testify to. Well—

MR. WHITCOMB: No.

THE COURT: —all right.

MR. WHITCOMB: I would rather have his talk without my talking to you—

THE COURT: I understand.

MR. WHITCOMB: —because I would be leading too much.

MR. MORRIS: I would rather you would not lead this witness.

THE COURT: I understand, certainly.

By MR. WHITCOMB:

Q. I want you to tell the court completely if that is what you had in mind when you say you didn't tell these things to any detail?

A. Yes, sir, that is right, sir.

Q. You were afraid of saying something erroneous?

A. Yes, sir.

Q. Namely, you had not told me about this coning until last night?

A. Yes, sir.

Q. Isn't that the fact—

A. Yes, sir.

Q. —and absolute truth?

A. Yes, sir.

Q. But were broad things you had talked—

A. Yes, sir.

THE COURT: It is not an important matter.

THE WITNESS: On the general subject, yes, sir.

MR. MORRIS: There is one phase that bears some little importance.

Re-cross-examination.

By MR. MORRIS:

Q. Mr. Cooper, I think you understood the court—

A. Yes, sir.

Q. —that if you had told the details of the Philadelphia operation, the Electric Storage Battery operation to anybody before you came here, it was all right for you to say so?

A. Yes, sir.

Q. You don't have to deny it. With that aid from the court, do you want to correct your testimony at all?

A. Well, I would like to correct that. I have explained to Mr. Whitcomb last night, the operation with Mr. Nagle, the operation in general of the process that the mills working—.

Mr. Nagle was an operator that operated with me at the Electric Storage Battery. He is not employed

with USL. I do not know when Mr. Nagle left the Electric Storage Battery. It was in or around '33 or '34. I am not sure. Generally speaking, in my application, I stated the same thing as in the conversation last night. When one applies for a position and is asked to state the nature of one's work, you have to state it fully to your ability. That I did. I did not explain in the application about the mills shutting down. The first time after making the application that I explained that orally to any representative or officer or employee of USL was last night. I explained it to Mr. Whitcomb. Last night was the first time as I remember. I have explained that process to Mr. Reid of the USL. He is an engineer. I explained to Mr. Reid the same as I have explained it here this afternoon. That was before I was actually employed by the USL. I applied about two and a half years ago for a position when I made that statement to the USL Corporation, but at that time they didn't have any position for me and they were kind enough to find me a position with the Battery and Starter Company of Buffalo. That is where I was employed up until there was a position available for me at the USL. I explained that in my first application two years and a half ago. It was after I made that explanation about two and a half years ago that I found the position with the Battery and Starter Company. I did not give them any other information than that which I have talked about this afternoon. None at all. I didn't tell Mr. Reid about the oxidation content of the darker powder which filled the third, fourth, fifth and sixth drums and so on after starting of the mill afresh on Monday morning. I don't think he asked me that. I first discussed that with Mr. Whitcomb and Mr. Schaffer last night.

(Witness excused.)

MR. SCHAFFER: Plaintiff offers in evidence the file wrapper of the abandoned application for Shimadzu, serial number 431,473, Exhibit number 39; and the answers to interrogatories of the defendant and the amended answer to plaintiffs' interrogatory number 6, Exhibits 40 and 40-A.

(File wrapper of abandoned application of Genzo Shimadzu serial number 431,473 was marked Plaintiffs' Exhibit 39.

Answers to interrogatories by defendant were marked Plaintiffs' Exhibit 40.

Amended answer to plaintiffs' interrogatory number 6 was marked Plaintiffs' Exhibit 40-A.)

MR. SCHAFFER: Plaintiff offers in evidence the interference record in Interference in the United States Patent Office between Hall and Shimadzu, number 54,798 and 56,224, copies of which are now in the files of the Clerk.

MR. MORRIS: That is the whole record, isn't it?

MR. SCHAFFER: Yes.

MR. MORRIS: That is the consolidated record.

MR. SCHAFFER: The entire record has been filed by the defendant in connection with the inspection.

Your Honor, in connection with the bills of particulars of both parties it is understood that those are now in evidence, are part of the record, having been filed.

MR. MORRIS: Not in evidence, but a part of the pleadings.

MR. SCHAFFER: Part of the pleadings, is that correct?

THE COURT: All right.

MR. SCHAFFER: The exhibit number for the Interference is 41.

(Interference records between Hall and Shimadzu number 54,798 and 56,224 were marked Plaintiffs' Exhibit number 41.)

(Discussion off the record.)

MR. MORRIS: You needn't put the paper in, but it will be subject—

MR. WHITCOMB: Sure.

MR. MORRIS: —to our inspection any time we want. It is the long license agreement between Shimadzu and the Northeastern, and we do not require them to prove it formally, and if they want to read parts of it in the record, why, we have no objection, provided it remains subject to our correction.

THE COURT: All right.

MR. WHITCOMB: I would rather have the witness just state what it is.

MR. MORRIS: We admit—

MR. BETTS: It is stipulated that there is an exclusive license from Shimadzu to the Northeastern Engineering Corporation.

MR. WHITCOMB: Proffer of the paper being made.

MR. BETTS: Under the patents in suit.

MR. MORRIS: I think you would have to show by reading in the record that part which shows—

THE COURT: Oh, can't we short-cut that? I

will say without looking at it that I will interpret that as an exclusive license, unless the defendant shows me that it is not.

MR. MORRIS: You see, we don't know.

THE COURT: But you will have opportunity to study it.

MR. MORRIS: By the inspection.

THE COURT: Yes.

MR. MORRIS: Yes.

THE COURT: At any time during the trial.

MR. MORRIS: Yes, that is perfectly all right.

MR. BETTS: It is stipulated that when the witnesses have spoken of the Exide mills and products from them that they mean the mills operated by the defendant in their plant at Philadelphia.

(Discussion off the record.)

MR. SCHAFFER: If Your Honor please we are at the point now where we would like to inspect some of these papers we asked for. Beyond that we have about come to the conclusion of our prima facie case.

(Discussion off the record.)

PLAINTIFFS REST.

Counsel for plaintiffs offered in evidence the translations of Exhibits 7 and 8, subject to correction.

which were received in evidence and marked "Plaintiffs' Exhibit 7-A" and "Plaintiffs" Exhibit 8-A" respectively.

DEFENDANT'S EVIDENCE.

Counsel for defendant offered in evidence Defendant's Exhibit A for identification, being the sheet upon which Dr. Clark while on the witness stand wrote certain chemical formulae which was received in evidence and marked "Defendant's Exhibit 1".

Counsel for defendant offered in evidence as Defendant's Exhibit 2 the work sheet produced by Dr. Clark at the request of the defendant and marked Defendant's Exhibit B for identification, being the measurements for the film represented as number 6 on Plaintiffs' Exhibit number 21, which was received in evidence and marked "Defendant's Exhibit 2".

EDWARD W. SMITH was called as a witness on behalf of defendant and first having been duly sworn testified as follows:

Direct-examination.

MR. MORRIS: I propose to prove by this witness briefly this, that Mr. Smith has been associated with the Electric Storage Battery Company for about thirty-five or thirty-seven years, that in 1906 he went to Germany to see the process that was being used in Germany in a revolving drum mill, that thereafter the defendant imported some of this material, and it was made into plates; in 1912 and 1913 Mr. Smith went

back to Germany and saw their improved process of a revolving mill, getting powder therefrom; that in 1916 or thereabouts the Electric Storage Battery Company installed a mill and made the product, the oxide, by revolving chunks of lead or balls of lead in a mill, that they put that into commercial operation, they made plates out of it and sold the plates, and that the mill was then shipped to the Willard Storage Battery Company, out in Cleveland, and the Willard Storage Battery Company used the same mill, with the same results; they made oxides from a very low degree of oxidation up to a high degree of oxidation when I am speaking of high degrees of oxidation I am not particularly concerned as to whether Your Honor interprets that at the moment as meaning any particular form, to us it is PbO, always, I mean that it was calculated as PbO and as PbO it may have been twenty, thirty, forty, fifty, sixty, seventy, eighty or ninety per cent; that the Willard Storage Battery put the product of the mill—they used it in 1920; we began in 1916—they put that right in with their other material and made plates out of it in the usual commercial way.

I think that—

THE COURT: All right.

MR. MORRIS: —may give you some idea of what we intend to prove by this witness and also by several other witnesses.

By MR. MORRIS:

I reside in Germantown, Pennsylvania. My occupation is work with the Electric Storage Battery Company, the defendant in this suit, as engineer. I have been connected with the Electric Storage Battery Company since the latter part of 1897 which was about thirty-seven or eight years ago; I guess. I first went in as what was called a cadet, a sort of training course,

where they trained young men in the work. I stayed in that capacity for some months or possibly a few years. From that I was made factory engineer and continued in that capacity until two or three years ago. My present title is Manager of Development and Design Division. Prior to going with the Electric Storage Battery Company I had a college course at the University of Pennsylvania with the degree of Bachelor of Science in Chemical Engineering. The business of the defendant, The Electric Storage Battery Company, since my connection with it, has been the manufacture of electric storage batteries for all kinds of purposes.

I visited Germany in 1907 in the summer. While there I visited the works of the Accumulatoren-Fabrik Aktiengesellschaft which was the large storage battery company in Germany operating all over Europe, which I will hereafter refer to as A. F. A. I went into the mill of A. F. A. while in Germany. It was engaged in the manufacture of all kinds of storage battery plates for storage batteries. They were making a large variety of storage battery plates, but the pasted plates to which I presume you refer were made at that time mostly with active material of the ordinary oxides. But they were making some of their plates at that time with oxide made from a new mill which they had recently put up, a cylindrical mill which contained lead balls which were rumbled up within. The product of that mill in Germany was called "Bleistaub", which means lead dust in English. At that time I made a brief note recording the fact that I had seen the mill and telling in a very preliminary sort of way what it was about. This paper which you hand me is the note, the page taken from my original note book showing the note that I made while in Germany with regard to this mill on August 30, 1907.

Mr. Morris: I offer it in evidence as Defendant's

Exhibit number 3. It is number one in Your Honor's book.

MR. WHITCOMB: Just for the purpose of the record, we want to object to any testimony of a public use in a foreign country as far as that part of it is concerned.

THE COURT: Well, it will be taken subject to the objection under the equity rule.

MR. MORRIS: In order that Your Honor may understand our position as we go along, I am not disputing the general law with respect, or the established law with respect to public use in a foreign country, of course I am not, but when Mr. Smith knew of that he brought that knowledge back to America, and that then became American knowledge, and he put that knowledge into use in America, so that we only show where we got that knowledge and when we got it, and what that knowledge was.

THE COURT: Yes.

The page dated August 30-07 from the note book of the witness was thereupon received in evidence and marked "Defendant's Exhibit 3".

(The witness resuming testified):

After returning to Philadelphia, I arranged to have a sample of the lead dust sent to Philadelphia and from this sample had a number of Electric Storage Battery Company's Exide grids pasted for test purposes. I have the date when some of the plates were made from that lead dust. January 15, 1908, the laboratory test number 4235 was started, calling for setting up and testing certain cells with plates made by me from the German lead dust and according to their process. We subjected the plates so made to a life test.

I will tell you generally what the process that I saw in Germany consisted of.

They had an iron mill, about sixty inches in diameter, thirty-eight inches long, mounted on a horizontal axis and caused to rotate at a low rate of speed, thirteen or fourteen revolutions a minute. The drum of this mill was perforated with a considerable number of small holes, about an eighth of an inch in diameter. Lead balls, small lead balls five-eighths of an inch in diameter about, were introduced into the mill, and were there subjected to the action of the air within the mill and to the grinding action of that mill, so that out of these holes there came fine powder of so-called Bleistaub, or lead dust.

If I may go back just a step, the mill itself was surrounded by a wire gauze screen, attached to the mill and rotating with it. The lead dust came first into this space between the two. That separation was approximately six or seven inches. Then the lead dust came through, afterwards finally came through the screen, this outer screen, fell down into a casing with a conical bottom, conical or pyramidal, and there was concentrated into a pipe which led down at an angle of about forty-five degrees to the collecting kegs, steel kegs or barrels, in which the stuff was finally collected.

We imported a second lot of lead dust from Germany after this first one. I have a copy of the purchase order sent to the A. F. A. for the second lot. This paper that you hand me is a purchase order dated December 21, 1908 calling for five hundred pounds of lead dust for positive plates, sent to the A. F. A. in Berlin.

(Counsel for defendant thereupon offered in evidence as Defendant's Exhibit 4 the purchase order dated December 21, 1908 to A. F. A. for five

hundred pounds of lead dust for positive plates, which was received in evidence and marked "Defendant's Exhibit 4".)

We made other plates from this second importation of lead dust. We put those plates on test. This Exhibit, Defendant's Exhibit 5, which you hand me is a note from me to Hr. Howard who was the director of the laboratories, describing some plates which I had made from this second lot of lead dust and given to him for test. It is dated seventh month, twentieth, 1909, and the note was evidently handed in some time after the test had been started. The note says: "Mr. Howard, regarding plates Z 155, etc. I find Z 155 standard M V positive grids, pasted with German lead dust, pressed, and all directions followed as closely as possible. 157-58 and 59 also M V positive grids, pasted with a newly imported lot of lead dust, the pressure being varied, in all other respects the German directions closely followed—and also sundry notes of the weights of active material in those plates."

(Counsel for defendant thereupon offered in evidence as Defendant's Exhibit 5 the note dated 7-20-09 from Smith to Mr. Howrad which was received in evidence and marked "Defendant's Exhibit 5").

This paper which you hand me is a copy of a letter written by me to Director Roderbourg of the A. F. A., dated April 17, 1909, treating the various matters, and near the last occurs this paragraph: "The keg of lead dust arrived in good condition and we at once made up some samples with it", that is, from it. "It is quite likely that in our former tests we applied too much pressure to the plates, and thus cut down the capacity", and so on. There is one more thing I might

add there. In that paragraph also occurs this: "To make this test as complete as possible we are sending you an order for 50 of your latest standard positive grids and 25 finished positive plates of the same type, all of the size nearest to our MV that is 8⅞ x 5¾"". I think that the only part of this letter that pertains to the issues here is all on the last page, the paragraph most of which I read.

(Counsel for defendant thereupon offered in evidence as Defendant's Exhibit 6 the first and last pages of this letter dated April 17, 1909, from the Factory Engineer to Director Roderbourg of the A. F. A. which were received in evidence and marked "Defendant's Exhibit 6").

Mr. Howard to whom I have referred once or twice, is and has been for many years the chief chemist of the Electric Storage Battery Company, a part of whose duties is the operation of the commercial laboratory which takes care of all of the life tests and any other tests of batteries. This paper which you hand me is a voucher dated February 20, 1909, showing the price that was paid for this second importation of lead dust. It is marked "Payable to Brown Bros. & Co."" (Counsel for defendant thereupon offered in evidence as Defendant's Exhibit 7 the voucher dated February 20, 1909, to A. F. A. which is received in evidence and marked "Defendant's Exhibit 7"). I would like to add that there is a slight apparent contradiction in that voucher, because it speaks in a note at the side, pencil notation, as if it were plates that were being imported instead of lead dust. The explanation of that, with the marking of plates, means that the experiment was charged to plates. It was charged to the manufacture and development of plates.

Some of the records in our plant we keep for a

long time, some of them are thrown away. When we want them they are often not to be found. But in this particular case, we were able to find a great many of the old records.

Defendant's Exhibit 8 which you hand me is a cancelled check made to the order of Brown Bros. and Co. dated February 20, 1909, for the payment of this second importation of German lead dust.

(The check dated 2/20/1909, from the Electric Storage Battery Company to the order of Brown Bros. and Co. for $25.80 was thereupon offered and received in evidence and marked "Defendant's Exhibit 8.)

Brown Bros. are bankers.

Included in test 4235 were a number of plates made complete in Germany, according to their standard method, in addition to the plates which were pasted in this country with the German lead dust. The test folder comprises in all 24 individual tests and covers the interval of time between January 15, 1908 and October 27, 1909. The test folder complete is preserved in the company's records.

I made another visit to Germany in the winter of 1912 and 1913, when I again visited Hagen. That trip was undertaken largely for the purpose of getting the latest information on the manufacture and use of the lead dust. I did get such information as fully as I was able. I investigated very carefully the operation of their lead dust plant which by this time had been increased, as well as the methods of manufacturing lead dust plates, which by this time had become a standard commercial product. While in Germany I made a number of notes showing what I saw and learned there in the A. F. A. plant.

MR. MORRIS: I offer those notes in evidence as Defendant's Exhibit number 9.

THE WITNESS: May I make a slight correction? What you are offering in evidence is not all of my notes, it is typical pages, a number of them.

(Pages from the note book of the witness, dated in December 1912 and January 1913 were thereupon received in evidence and marked "Defendant's Exhibit 9".)

The papers that you hand me as Defendant's Exhibit 9 are typical pages. I will point out to you in those pages what I found in Germany at that time and the knowledge that I there gained and brought back to America with me.

The first of these pages is dated December 12th. It has a heading at the top, "Dr. K.", which signifies that the information was given to me by Dr. Kieseretzki, who was the man who had developed and perfected this process of making lead dust, and its application to storage battery plates. I had many conversations with Dr. Kieseretzki in which he told me as much as he was able to and as I was able to understand, he talking broken, very broken German, Russian-German, and I talking exceedingly meagre German-English, but between the two he was able to convey a number of ideas to my mind as to what they were doing. I recorded those ideas on those pages, this particular one on December 12, 1912. The next is dated December 20, 1912; another one not dated but taken from the same note book is also from Dr. Kieseretzki. I have some that were given me by Dr. Melchiker who was the German chemist at Hagen at the time in the A. F. A. I have others that are sketches showing the mill, taken from the actual installation. Various parts of

these notes were given to me by the foreman who operated the mills, and some by Dr. Roderbourg, some by some of the other people who knew about the use of these plates and their performance. I had access to the whole plant and to the methods.

Mr. Whitcomb: There is another, further objection on the point of patent law, in our opinion, that we want to register at this time and have it apply, namely, that the knowledge incorporated in this country, as we interpret the law, must be knowledge of the thing in this country, prior knowledge and use, knowledge or use, it does not mean just written knowledge unless it is published in this country, so we want that further objection.

The Court: I will note the objection. I am wondering whether it is necessary to go into this as elaborately as we are doing, because I don't know that it is even corroborative of what was done in this country or what was published in this country. Suppose he did get all this information, suppose it is conceded that he got all this information in Germany, it does not prove that he made use of this particular information when he came to this country.

Mr. Morris: But the statute goes a little further than that, as I understand it, it is knowledge which prevents a patent, where there is knowledge of it in this country, 4886 of the Revised Statutes deals with knowledge as well as use, but we are going to follow this now immediately by showing that we made plates and sold them in 1916 and 1917.

Mr. Whitcomb: That might apply to the plates but not to the process or the machine.

The Court: Well, that is another question I have in mind, whether the testimony here indicates anything

more than the fact that powder-paste was used instead of solid plates.

Mr. Morris: It is one of the bits of evidence which goes to show that here was a process that was being employed, that the knowledge of it came to us from Germany initially in 1906 and 1907, the knowledge of it has been here since that time, the plates were made of it, they were sold and put in use, and prior to the earliest date of any alleged conception on the part of the plaintiff here in suit.

(The witness resuming testified):

I have Exhibit 9 right here. Among other things showing knowledge which I acquired of the process and mill, I find in the Exhibit:

Well, lead powders intended for cabs, getting very hard, constant service; mill is controlled entirely by the lead powder produced. When once a mill gets running right the product is weighed and the same amount of balls put in as powder comes out, plus a small amount for oxidation.

One motor drives two mills at the same speed.

The powder is slightly greenish. It must feel smooth between the fingers, and very fine.

Specific gravity is mentioned here, a note of Dr. Kieseritzki, taken from Dr. Kieseritzki, the lead dust very likely is a suboxide Pb_2O. It becomes thus slightly oxidized in descending from the mill to the keg, and this becomes, therefore, one of the important steps in the manufacture. The mill itself is closed up tight except for a small opening through which the balls enter; the main entrance for air is by means of the two small openings in the cover of the keg, A in figure 1. These openings must not be closed. If they be closed, and no air allowed to enter, the powder enters the kegs in rather emtallic condition, very black

in color and very ready to oxidize. It then takes up oxygen in the keg, which apparently is not air tight, becomes red hot, and so remains until it has become thoroughly converted to litharge.

In other words, this powder was exceedingly reactive, and there is a slight discrepancy in that particular part of my note, because it leaves out the holes in the mill which allow the air to enter within the mill. The perforations are about an eighth of an inch, some fourteen hundred of them in the mill. The powder where the volume of air was reduced was more reactive than where these holes were kept wide open. If less air entered the oxidation was lower. It was less reactive when the oxidation was higher.

After returning to Philadelphia from this trip to Germany in 1912 and 1913 I wrote out a general report of the trip that was handed to the President of the company. This report opens with the subject of lead dust, and the first ten pages are devoted to it. The report is divided into a number of headings, "Status of Lead Dust in Germany", "Applicability of Lead Dust for the E. S. B. Co.", "Probably Cost of Manufacture of Lead Dust Plates", "Manufacture of the Plates". That report is still in existence but I don't happen to have it among my notes.

Mr. Whitcomb: If Your Honor please, I think the record ought to show that this witness is reading his answer from a book, apparently prepared. I don't know that it means a lot, but I think it ought to be in the record.

The Court: All right.

(The witness resuming testified):

I am using notes. These notes were prepared by me and under my direction. I have checked the ref-

erences. It is merely for convenience of memory in testifying. Largely to save time, so that I will have the thing as condensed as possible, and delay the Court as little as possible.

The lead dust as used by the A. F. A. in January 1913, was a fine powder, consisting of lead in a somewhat oxidized condition, or more accurately, perhaps, some of which was oxidized and some was not. It was of a dark color, slightly greenish tint. It felt quite fine between the fingers, and it was very decidedly pyrophoric, that is it would burn quite readily in the air, when touched off with a match it would smoulder and the whole thing gradually burn, get hot and turn to litharge. They were able to change in the manufacture various of these qualities, such as color and reactivity, over quite a wide range, by the amount of oxidation and the fineness. Standard practice as I discover it at that time was to produce material of an oxidation, as they put it, material of a lead content of ninety-four to ninety-five per cent, and that translated into the terms that we have since used has content of PbO from fifty-six to about seventy per cent. The color of their commercial product was dark, dark color, slightly greenish in tint, possibly slightly gravish, a color very difficult to define accurately. They placed a good deal of reliance on tests of apparent specific gravity made by taking a small porcelain crucible and pouring the stuff into it loosely and then scraping off the top, and the specific gravity was slightly above 2, 2 to 2.3. That is given in some of these notes. Apparent specific gravity is taken by taking a certain volume of powder and comparing its weight with a weight of like volume of water. Stated a little more simply, it is the weight per cubic centimeter, weight in grams per c. c. You are right that there is a reference in one of my notes, Defendant's Exhibit 9", to the composition of

the lead dust as ninety-five or six lead, and a further remark that the lead is thus about half oxidized. I don't see that reference but I remember it is in here. The lead dust as made in Germany of which I obtained knowledge in 1912 and 1913 was very reactive to oxygen. It would very readily take fire in the air. It would become red hot and give off a little smoke and the lead content which it contained would be oxidized to litharge, so that by the time the combustion was through the whole thing was bright yellow litharge. That took place even unintentionally, spontaneously in the kegs in which the material was packed. The kegs were not literally air-tight. Those kegs were steel drums. The A. F. A. knew that the material oxidized very readily, that it began oxidizing immediately after it was made. They therefore made a rule that it must be used within three days from the time it was manufactured, in order not to use any of the very high oxidation, that is a higher oxidation than approximately the figures that they have given.

(Counsel for defendant thereupon offered in evidence, as Defendant's Exhibit 10, a blue print marked "Abbé Engineering Co. New York, dated July 24, 1915, Special Cylinder for Electric Storage Battery Company", which was received in evidence and marked "Defendant's Exhibit 10).

Exhibit 10 which you hand me is a drawing by the Abbé Engineering Company, dated July 24, 1915, and shows a mill which we purchased in this country, from this concern, made according to information which we had given them, and in all respects duplicating exactly the German mills of which I have been talking. It will be noticed that this mill has a number of small holes of slightly under an eighth inch diameter at the smaller end, at the inside. I find that at the bottom of the

sheet. And I would like to point out here this slight discrepancy that I mentioned in my notes because this shows the holes by which the air could enter the mill in addition to possible leaks at the trunnion. Trunnion means the large bearings by which the mill is supported, one at each end, which you, as a layman, might refer to as an axle. One of these trunnions or axles is hollow, for the introduction of the lead balls within the mill. The other is closed.

Mr. Whitcomb: We might make an objection that this is a blue print, we don't know what time this blue print was made, or if the original tracing is available. Sometimes they make blue prints just—

Mr. Morris: Just what?

Mr. Whitcomb: —a month ago; secondary evidence, a blue print is, prima facie.

(The witness resuming testified):

I can give you further information by referring to my notes I think. (Counsel for defendant here offered in evidence drawing marked "Supports and House, Lead Dust Mill, The Electric Storage Battery Co.", dated 9/25/1915, which was received in evidence and marked "Defendant's Exhibit 11).

Referring to my Exhibit 7, which is "Defendant's Exhibit 11, I can show you the tracing in this case of the building which was erected at our 19th Street plant, showing the outline of this mill, this Abbe mill, which was afterwards installed there. The drawing bears date of ninth month, twenty-fifth, 1915, gives the weight of the machinery, the weight of the charge within the mill. This building, not only the blue print, but the building is still in existence and can be seen at the plant of the Electric Storage Battery Company, with the marks on the beams, and in general corresponding to this drawing, although the mill itself is not there.

That is the original drawing. If I remember right, we had a requisition for that building, didn't we? We gave to the Abbe Engineering Company a drawing of what we wanted, they made this drawing from ours, elaborating it still further, giving the details which they proposed to furnish. The original tracing of this drawing I have never had in my hands, but this is the drawing from which we ordered the mill. This blue print is the record by which we ordered the mill from the Abbe Engineering Company. This blue print was our original record. I can tell that by the number here pasted on the drawing, O. F., which means outside drawing, of a certain size. That was kept in our list of drawings as an outside drawing, not made by us. The mill made according to this drawing of Abbe's was set up, finished and ready to run during the early part of 1916. I had that Exhibit 10 well before that time, because the mill had been purchased and set up in accordance with that print. It was finished and ready to run in the early part of 1916.

Mr. Whitcomb: Is your Honor going to make a ruling on this blue print, or not?

The Court: Oh, no.

Mr. Whitcomb: Just take it subject to any objection?

The Court: Surely.

(Counsel for Defendant here offered in evidence as Defendant's Exhibit 12, blue print entitled "Projekt fur die kugelmuhlenanlage in Lille" which was received in evidence and marked "Defendant's Exhibit 12.")

This exhibit is a blue print handed me in Germany in the winter of 1912 and '13, showing a projected in-

stallation of two mills at Lille, France, by the A. F. A. and given to me as a basis for the setting up of our mill here, and this general installation was followed in the setting up of this Abbe mill which I have just told you about. That shows the same general arrangement. That is the only copy I have. It shows two rotatable mills. The mills are located on a platform about fifteen feet high, mounted within a casing, the pipe running down from that casing to the collecting drum at the bottom. Where the pipe runs down into the drum is a kind of a conical heading to the drum, where the pipe runs in. In that conical heading of the drum there are a number of holes, shown plainly in the drawing, and in describing the operation of the mill to me they were always very careful to say that some of those holes must be left open in order to allow a stream of air to pass up the pipe and into the casing surrounding the rotating drum, in order to get some—to produce the necessary oxidation of the balls, the air, of course, coming into the interior of the mill itself through the small eighth-inch holes. And these holes in this pipe were one of the means which they used for controlling the process, they had to always keep some of those holes open, sometimes they would shut them down partially for a short time, but they had to let the air go in there, and that was described to me as one of the essential parts of the process. This shows a mill that was rotated on its trunnions. The feed of the lead part, chunks or pieces, was made through one of the trunnions, which one was hollow. The mill was then rotated in the neighborhood of twelve, thirteen or fourteen R. P. M. It is stated in my notes more accurately. It was about thirty-eight inches long, I think. Its diameter was sixty inches. The perforations in the outside of the drum were slightly under an eighth of an inch, and as I remember about fourteen hundred of

them in the mill in the outside wall of the mill there were about 1440 or 50. The mill was surrounded by a screen. And the screen in its turn was surrounded by a fixed casing. There was a sort of leg or discharge chute at the bottom of the fixed casing, and the holes or openings to which I have just referred were at the bottom of that chute. This chute was not an open chute but stove pipe shape, roughly speaking. At or near the bottom of the chute there were two or more openings used to control a stream of air which flowed up through this pipe. It would be right to say that it controlled the volume of air that went into the casing surrounding the mill, and, therefore, also the amount of air which entered into the mill. A question naturally arises in that connection, which I think I might as well explain, that there is no exit for that air shown at the top of the casing, the air got out of the casing by various leaks and cracks and crevices as best it could, but there was no question about there being a distinct flow of air up this pipe and around the casing. The product was oxidized. It came out through the holes in the drum and then into the surrounding screen which revolved with the drum and passed through the mesh of the screen into the fixed casing or housing, the bottom of which was hopper shaped. At the bottom of the hopper or funnel was this stove pipe appearing outlet.

I find in one of my notes here that I did not read, that in May 19, 1915 a requisition was made out calling for one special ball mill, as per Abbe Engineering Company's specification dated March 29th, 1915, drawings to be submitted and approved before commencing work. That is the drawing which has been given as "Defendant's Exhibit 10".

Referring to the German mill, the charge in the mill was in the neighborhod of a couple of thousand

pounds. It varied a little up and down. There was no very accurate means of determining what it was. The heat was supplied to the mill by the reactions and by the friction in the mill, friction and chemical action, the friction of the balls rolling over each other as well as the friction of the balls and the drum together.

THE COURT: Judge Morris, is this the A. F. A. Mill?

MR. MORRIS: Yes, sir.

After this friction began, the surface of the balls was worn away, there was oxidation, no doubt, worn away and dropped through the holes. In the light of present day knowledge, there is no question that the oxidation of the surface occurred first before the wearing away. The oxidation of the balls occurred before there was wearing away or breaking up of the lead. At the time I didn't even comment about that.

There was no direct measurement of the temperature inside the mill. There was a thermometer in the casing, outside, but there was no measurement of the temperature inside.

I recall that the thermometer was outside of the revolving screen between the revolving screen and the fixed casing surrounding the drum. I think I have the recorded temperature. I didn't find the temperature at which the German mill was operated but we can easily get it.

Control of the product was a rather intricate matter in this old German mill. It depended upon the amount of balls in the mill, it depended on the temperature and to some extent on the speed of rotation and the amount of air. It was possible to control the temperature only indirectly. It required a very nice balance of these two factors in order to get the mill working properly and to keep it working properly. They

did keep it working properly. There was a great deal of personal skill required and the man had to get accustomed to it in order to be able to hold the product that he wanted, but they had that skill. I learned while there what was essential to control the product. I aranged to send over to Hagen some M V grids of different thicknesses.

(A print headed "Blechmantel" No. 14-166, was here offered and received in evidence and marked "Defendant's Exhibit 13".)

Referring to "Defendant's Exhibit 13", that discloses the shell on the drum of the German mill; the cylindrical shell. The rounded circle discloses that. That is marked fifteen hundred and twenty millimeters, which corresponds very closely to sixty inches diameter. It shows a total of fourteen hundred and eighty-six holes. That fourteen hundred and eighty-six is on the right hand side near the upper corner, fourteen hundred and eighty-two locher. Those red cross signs near the right hand middle of the page represent the center of it, of which there are fourteen hundred and eighty-two in the entire wall of the drum. This blue print also shows that the drum was made of steel casing, the thickness and strength of the shell ten to thirteen milimeters and the length eight hundred and ninety milimeters, or about thirty-seven inches, or something like that. It may be of interest to say that it shows the total area of the holes to the interior of the mill, which if figured out, shows the sum total of the small holes, also a sketch of one hole about four and a half inches in diameter. Blechmantel means sheet covering. The trommel is the mill. Kugel is bullet. Trommel is a drum, I think, that circular part. Drum of the large ball in the old turbine house.

MR. MORRIS: Ball and bullet are close together.

THE COURT: Yes.

I got this blue print at Hagen in the winter of 1912, 1913, although the date of the drawing is much older than that. 1907 is the date of the drawing, but it is not when I got it. I brought it back with me when I returned from my visit in 1912, 1913.

Returning to the grids which I had sent to Germany, owing to the fact that the lead dust in transportation was necessarily kept for a matter of weeks or perhaps a month or more, I realized that in that process it was subject to further oxidation, so that by the time we got them to this country, and pasted the grids, it no longer would be strictly characteristic of the original material. I, therefore, had some of our grids sent to Hagen, pasted there with material fresh just as they made it, and used it. Those plates were tested in our laboratory. Some of them were tested here and some of them were tested there, both our grids and their paste. Our laboratory test number was forty-four eighty-seven. The first cells in this test were started on or about April 11, 1913. The last ones were July 22, 1914. In all, around twenty-two cells were tested. We also had reports from Hagen of the tests which they made on the duplicate plates. They sent us some reports as to the results of their tests on these same plates. That is our folder forty-four eighty-seven.

As a result of these investigations and knowledge that I obtained in Germany in 1912 and 1913, which showed that this material was perfectly practical to use, we decided to put in a mill of the German type and in order to put that decision into effect, there was an order issued, what we call a standing order number 452V of May 19, 1915 which reads "All expenses covering building, machinery, etc., in connection with the experimental manufacture of lead powder". Then on

October 18, 1915, purchase order No. 38409 was issued to the Pomeroy Construction Company calling for "Brick corrugated iron building for lead dust mill, erected complete as per your estimate October 15th, 1915 and our drawing SB-288". On May 19, 1915, we issued requisition M-9745 calling for "one special ball mill as per Abbe Engineering Company's Specification dated March 29, 1915, drawings to be submitted and approved before commencing work". That drawing was submitted and this was (indicated by counsel). I have "Defendant's Exhibit 10". There are some further drawings showing the casing surrounding the mill.

I might say that there is one exhibit that shows our drawings taken directly from the German drawings which is turned over to Abbe for them to copy. There is another showing that casing of the mill as we erected it. That is our drawing and beafs date of—

(Counsel for Defendant here offered in evidence as Defendant's Exhibit 14 print numbered SB-201, stamped "Electric Storage Battery Company, factory department, dated 3/11/15" which was received in evidence and marked "Defendant's Exhibit 14".)

(The witness here examined "Defendant's Exhibit 14".).

It is a copy we made of the German drawing. It is very nearly the same, but it is not the same drawing. This is what we turned over to Abbe for them to copy. That is the drawing which we turned over with regards to the mill. "Defendant's Exhibit 14" was turned over to Abbe. "Defendant's Exhibit 10" is the drawing on the larger scale and more detail, the approved drawing from which we purchased the mill. That is my last remarks are addressed to "Defendant's Exhibit 10".

(Counsel for Defendant offered in evidence as Defendant's Exhibit 15, blue print No. SB-286, dated March 23, 1916, which was received in evidence and marked "Defendant's Exhibit 15".)

(The witness examined the drawing.)

This drawing 15 shows the outer casing, the surrounding casing which was installed outside of the Abbe mill. It shows a casing, steel casing, sheet iron casing, which was erected after the mill was in place in the building, and inclosing the mill. The inverted cone-shaped thing near the left center of the page is for collecting the dust that came from the holes of the mill and screen to small boxes, until it could be eventually taken down to the keg underneath. The combined cylinder and inverted cone at the left upper hand corner, is another view of the same casing. This semicircle at the right hand upper corner of the drawing is the upper portion of the casing. The parellelogram immediately below that is the top view of the upper casing. And the large parallelogram in the middle or bottom of the sheet is a top view of the lower half of the casing. All these last questions and answers have been addressed to "Defendant's Exhibit 15".

The mill was completed in the early part of 1916, the exact time of which I have no record but it was early in 1916, before the middle of 1916. The mill was then put in charge of W. E. Kershaw, who was the head of the Research Department. Mr. Kershaw is still with the Electric Storage Battery Company. He is in Court today. Mr. Kershaw is the gentleman who is now about to stand. At that time I gave to Mr. Kershaw all the information and notes and data which I had collected in Hagen and as much explanation as I was able to give him.

We got from the mill this same product of lead

dust partially oxidized, or, as I should say perhaps, a powder containing some oxide of lead and some metallic lead. As nearly as I could tell, it corresponded substantially in every respect with the German lead powder known by them as bleistaub. Kershaw operated the mill and explored its possibilities. He found he was able to vary the degree of oxidation through quite wide limits.

(A note book headed "H-3-16" was here offered and received in evidence and marked "Defendant's Exhibit 16").

This is Kershaw's original note book under date eighth month third, 1916 and shows that he started to run that German mill 235, finish 440, quite a short run. It shows temperature of one hundred and twenty-one degrees, doesn't say whether it is Fahrenheit or Centigrade, fifteen revolutions, gross weight one hundred and fifty-six pounds. There is a special notation, eighth month, fourth, 1916, the next day, a similar notation as to temperature, revolutions, gross weight, stop and so on.

(A page of the note book headed "8-17-16" was here offered and received in evidence and marked "Defendant's Exhibit 17",)

This note discloses that there were fifteen hy cap positive plates stamped LD, 1A, fifteen hy cap positive plates stamped SE-1B, made on that date. It shows that there were sixty pounds of lead dust in small mixing machine and shows the cc of sulphuric acid were added, mixed for ten minutes, made into a smooth paste, easily pasted, pasted on cloth like negatives, and the weights are given. The LD in this nomenclature signifies lead dust. This page, I believe, shows the date of the first plates that were ever made

in this country with lead dust produced in this country according to the process of which we are now talking.

Mr. Kershaw was not under me at that time. He was working as head of the Research Department. One of his special duties was to operate this mill, not the only one. He continued to operate the mill from that time on and there were other notes of the work that he did in the mill. He continued to produce lead dust and make sample plates.

Laboratory test No. 4793-D, was used for the testing of these plates made by Kershaw. It is quite a voluminous test, covering some fifty-seven different cells in all. The first pair of cells in this test were started August 16th, 1916 and the positives of these cells were marked LD-1A and LD-1B, the same plates, in other words as those shown in this record of Kershaw's note book which has just been put into evidence. Test No. 4793-D was continued and added to from time to time. The last cells contained there were started October 18, 1917. Kershaw operated the mill through the balance of 1916 and 1917 and through part of 1918. He has records covering this period.

(The following papers were here offered and received in evidence as here indicated:

Blue print headed "Lead dust mill record of operation for week 8-20-26-16" was marked "Defendant's Exhibit 18-A."

Blue print headed "Record of operation for week 11-5-11-16" was marked "Defendant's Exhibit 18-B."

Blue print headed "Record of operation for week 11-26-12-2-16" was marked "Defendant's Exhibit 18-C."

Blue print headed "Record of operation for week 3-4-10-17" was marked "Defendant's Exhibit 18-D."

Blue print headed "Record of operation for week 5-12-18-18" was marked "Defendant's Exhibit 18-E."

Each of these papers marked "Defendant's Exhibit 18-A to 18-E inclusive which you hand me, covers about a week's operation of the mill. The first one is dated eighth month, twentieth to twenty-sixth, 1916, headed, "Lead dust mill" and "Record of operation" for that week.

The top line curve shows the temperature readings that were taken, the next one the revolutions per minute, the next the lead in drum, the next shows the weight of the balls which are put into the mill, and the weight of the dust which is removed from the mill.

That first sheet, it may be noted, does not give any data as to oxidation of the product. Subsequent ones do.

The next record which I have is dated eleventh month, five to eleven, 1916. That gives the same information which I have already read, except it gives in addition the percentage of PbO contained in the product. Some of these notes I think he made prior to the figures. These figures at the left should be multiplied by ten, as applied to the percentage of PbO. It is so marked on the end, I think. That would give a percentage of material, calculated as PbO of sixty-nine to say seventy-three or seventy-four percent. The sheet also shows that the mill was run for a matter of about two and a half days, that they held the percentage of PbO practically constant throughout that time. It shows the plates—a note at the bottom here, LD No. 25, which means they were pasted 11-16-16, showing the product used from the mill came on that date and was pasted on the plates known as LD No. 25. The Exhibit number of the paper which you have

referred to is 18-B. I am now referring to the next exhibit which is called 18-C. It is dated eleventh month, twenty-sixth, to twelfth month, second, 1916. It shows temperature, revolutions, mill load in the drum, weight of dust per hour and equivalent weight of balls. All these Exhibits 18-A to E inclusive refer to the mill that was installed in Philadelphia as heretofore specified by me. There is a notation there, "Run CIM, lot number 1,794 plates". In other words, it shows 794 plates were pasted with this material and were put through the form department, where they were given this designation, No. CIM. That chart shows the revolutions started at about fourteen and a half per minute and after running half a day, they were reduced to about and kept about at eleven and a half with one jump to something over twelve revolutions per minute. The next Exhibit is, 18-D, which shows the operation of the mill on third, fourth to tenth, 1917. I might say also that the mill did not always run through the full week. In this particular case the mill ran for about two days. That gives substantially the same information as some of the preceding sheets, except it gives in addition the percentage of PbO as approximately seventy-five per cent. Turning to Exhibit 18-E, substantially the same information is conveyed by that chart for the period of weeks beginning May 12th and ending May 18th, 1918. In addition to what I have already said with regard to the making of the plates from this dust, I can say that the plates made from this dust were constantly put on the tests. The dust was used for pasting the plates. They were formed, some of them, by Mr. Kershaw some of them in the regular manufacturing department, and the plates subjected to all kinds of tests.

(Counsel for defendant here offered in evidence as Defendant's Exhibit 19, a letter dated November 28, 1926 addressed to Mr. Steinmetz and signed "GMH", which was received in evidence and marked "Defendant's Exhibit 19".)

This document, D 19, is a departmental correspondence note from Mr. Howard, the head of the laboratory, to Mr. Steinmetz, plant superintendent. It is dated November 28, 1916, and the subject is lead dust positives. I will read it:

"Subject: Lead dust positives.

"Confirming result of our conference on the above subject, we are to make forty-eight hundred MV-Hy cap positives pasted with lead dust to be used in making five sets of 58-MV-29 Hy Cap batteries to apply on New York order No. 70929 for the New York Railways Company.

"The paste is to be mixed according to process Number 23CL, copy herewith.

"Plates to be pickled according to regular process Number 23E1.

"Formation to be according to process Number 30BL, copy herewith.

"Yours very truly,

"(Signed) GMH."

Beginning with the latter part of 1916, which is referred to on the top of page 14 of my notes, I will read the notes, if you wish. During the latter part of 1916, a number of plates were made by Kershaw with lead dust which he had produced, and were sent to New York and put into operation by the New York Railways Company. The earliest reference we have found to these plates is contained in Exhibit 19, which is a note from Mr. Howard directing the factory su-

perintendent to make these plates. Under New York Sales Order No. 70929, Exhibit 20, dated 8 7 1916, seventy sets of fifty-eight MV-29 Hycaps are called for, and another Exhibit, Exhibit 11, shows that the original plan, calling for five sets, was changed, and that twenty-five sets instead of five were coming through, although, as a matter of fact, only twenty were finally installed. Another Exhibit, 21, gives further notes as to these same batteries, and is followed by another Exhibit, 22, from Lesley, of the Operating Department, to Welch, his representative in New York. Exhibits 23, 24, 25 and 26 are copies of other letters all referring to this same lot of lead dust positive plates, showing that the number of batteries was changed several times from the original five sets to a maximum of twenty-five, although only twenty were ever actually sent to New York. Exhibit 26 is a copy of the record kept by Lesley of the operation of the various batteries in the New York Railways Company. A note at the bottom shows that certain sets, marked with "*", had "B" positives in them, and these B positives are those referred to in the Exhibit 20, where they are defined as lead dust positives. It would appear from Exhibit 26 that twenty sets were finally installed, all of which were placed in service early in 1917, and renewed at various times from late in 1917 until the middle of 1918.

In order to get an idea of the magnitude of this order of special lead dust positives, it should be explained that each of the twenty batteries which finally went into service consisted of fifty-eight cells, each cell containing fourteen positive plates, and the whole twenty batteries, therefore, comprised 16,240 positive plates. The batteries were used for operating street railway cars, one battery in each car.

Exhibit 27 is a copy of Sales Order No. 70929 to

the New York Railways Company calling for the seventy sets of batteries already referred to, with the price of $65,838.50 duly noted. Notations on the back give data as to the date of shipment of various sets and show the railroad car by which each set was delivered.

On the 4th of August 1916, an agreement was made between the New York Railways Company and The Electric Storage Battery Company for the maintenance by the latter Company of the seventy special storage batteries of Sales Order Number 70929.

A copy of this contract or certain pages of it, with a letter of transmittal dated September 19, 1917, constitutes Exhibit 28. The original of this contract is in the E. S. B. Company's files. In May of 1918, it was decided to make a further demonstration of the lead dust positives in the service of the New York Railways Company, and this test is authorized and described in Exhibits 29, 30, 31, 32, 33 and 34. The first of these exhibits outlines the way in which the test batteries were made up and gives the identification marks to be used on the plates. These identification marks, however, were later changed, as appears in Exhibit 32, and the lead dust positives were finally marked LJB. Exhibit 33 shows that there were finally shipped 3248 of these LJB positive plates to New York in June 1918. These were put into service at various times from July 1918 up until December 1918, as shown on Exhibit 25, which is Lesley's record of the New York Railways Company. In this exhibit a footnote says that these batteries marked with a cross inside of a square contained the LJB positive plates, as referred to in Exhibits 29 to 34 inclusive and these plates remained in service with the New York Railways Company, although we lost track of them when our contract came to an end.

As a result of the successful demonstration made with lead dust positives by the New York Railways Company, as well as other favorable results obtained from this material in the laboratory, et cetera, it was decided, about the middle of 1918, to dismantle the original lead dust mill in which all of the lead dust thus far had been made, and to send it to the Willard Storage Battery Company in Cleveland, in order to allow them to make independent tests of the process and material.

Exhibits 35 to 38 inclusive are copies of letters in the files of C. W. Woodward, assistant to the general manager, and E. W. Smith. These letters authorize the shipping of the mill, and finally give a list of the pieces which were actually sent. Exhibit 38, the last one gives the price which was finally determined upon as between the Willard Storage Battery Company and The Electric Storage Battery Company.

The mill was installed at the Willard Factory in Cleveland the latter part of 1919, and was in operation during the spring and summer of 1920. The details of this operation are given in Reinhardt's report accompanying his letter of October 23, 1931 to Kwis, Hudson and Kent, which disclosed that the mill was operated for the production of lead dust which was used in the manufacture of commercial storage battery plates.

As a result of the work done by Kershaw, at Philadelphia, and by Reinhardt, at the Willard plant, and of the successful demonstration of the lead dust plates in the service of the New York Railways, it was decided to install a full size plant for the manufacture of lead dust at Philadelphia, the German mill having a very limited output.

In order to carry out this project, C. A. Hall was engaged by the E. S. B. Company, as a member of the

Factory Engineer's staff, in the plant superintendent's department, and to him was turned over all the information and data on lead dust which was available. This, of course, included Smith's German notes and all the records of Kershaw's operations with the German mill at Philadelphia, and the records of plates made from Kershaw's product.

Exhibits 9 to 17 inclusive are specifically among the records thus given to Hall.

After going over the information at hand, it was decided to install a larger mill of the same type as the old German mill used by Kershaw, and as the preparation of plans required a lot of work, a new draughtsman, A. H. Shaw, was engaged by the Factory Engineer's office, who worked on the problem, under Hall's direction for a number of months.

The new mill was to be of the same diameter as the old one, but longer, and perforated with many small holes to allow of diffusion into the mill of the air required for oxidizing the lead surfaces, and also to permit the exit of the oxidized lead powder produced.

Shaw started work July 19, 1920 and by October 15, 1920 completed a series of plans and details of the projected larger mill.

Exhibit 39, dated 10-15-1920, S. E. 2309, is the general assembly of the mill which was thus planned.

Hall, however, almost from the start, after going over the data handled to him, claimed that better results could be obtained in a more economical way by using a Hardinge conical mill, and began discussing it with Smith and Shaw. It was quite a radical change from the German mill, as seen by Smith in Germany, and as operated in Philadelphia by Kershaw, in that the German mill had a perforated shell, while the Hardinge mill had a solid shell. It was well recognized that means must be provided for admitting air to the

interior of the mill, and Hall claimed the air could be better introduced by means of the hollow trunnions of the Hardinge mill, which, due to its conical form, also provided for the discharge of the fine powdered product through one of the trunnions, and thus made the small perforations quite unnecessary.

Recognizing the potential advantages of the Hardinge mill, for the process involved, the Company finally decided to try it out, and accordingly a second-hand mill was purchased from the Hardinge Company, as per Smith's requisition of November 11, 1920, Exhibit 40.

The Hardinge mill was shipped in January 1921, as shown in shipping memo of January 7, 1921, Exhibit 41, and was installed immediately upon receipt according to Shaw's drawing, SF-2427-I, dated 11-14-1920, Exhibit 42.

Means for casting the required lead balls were also provided, so that it was possible very quickly to begin operations.

The installation was completed and the mill started up during January, 1921. It very soon developed that the amount of air admitted to the mill, temperature, rate of feed of lead balls, all had to be measured and controlled so as to produce and maintain its proper balance of the various phases of the process, and to produce lead dust of the required qualtities.

As the mechanical equipment of the installation was perfected, it developed that the Hardinge mill made possible a very wide and definite control of product.

The primary elements entering into the control proved to be:

Amount of air admitted to mill.
Temperature of the interior of the mill.
Load within the mill.

It became evident at once the Hardinge mill was started, that a definite flow of air through the mill must be provided and for this purpose a small blower, that happened to be on hand, was installed. This first blower confirmed the necessity of introducing air but proved insufficient and as a result a new blower was purchased May 5, 1921, Exhibit 43, and at once installed.

This new blower provided for a greater amount and better control of the air, and also improved the working conditions surrounding the mill, since it was arranged to exhaust the air out of the mill instead of blow it in, as had the first blower, Exhibit 44.

To learn about temperature effect, a recording thermometer was purchased January, 1921, as per Requisition L-80224, Exhibit 45.

It was at once installed, with the bulb placed inside the rotating mill, at such a position as to keep out of the way of the balls. This thermometer immediately proved to be of great value, but soon developed the fact that its upper limit of about two hundred and twenty degrees Fahrenheit was too low and hence a new instrument was purchased, April 13, 1921, Requisition L-80283, Exhibit 46, and reading to four hundred degrees Fahrenheit. This instrument gave a satisfactory record within the temperature range that was required.

With the air sucked out of the mill, there was, of course, a small amount of fine dust, and while this was at first simply turned loose into the outside air, it was both uneconomical and possibly detrimental to the health of neighbors. Hence, it was decided to put in a dust collector. Drawing S-80-A by the Sturtevant Company, Exhibit 47, shows the apparatus that was purchased on Requisition 111324, December 26, 1922. Similar collectors have been used on all subsequent mills.

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One of the outstanding features of the Hardinge mill in general is that the material within automatically grades itself, the coarse lumps remaining near the in-feed end, in the cylindrical portion, while the fines collect at the opposite end, and eventually discharge through the hollow trunnion at this point. It was soon found hat this same general characteristic held true when the Hardinge mill was used to produce lead dust, but nevertheless, some pieces, too coarse to be used for battery paste, were discharged along with the fines. To separate these coarse particles from the fine, a circular screen, or "bolter", was attached to the outlet trunnion of the mill, revolving with it, so that the fines were permitted to sift through the screen and drop to a collecting bin placed below, while the lumps passed out of the end of the bolter, where they were collected and eventually returned to the mill. Also a very coarse wire sieve was placed in the hollow trunnion itself, to prevent any stray balls which occasionally get to this part of the mill, from discharging into the bolter.

The whole mill is a little lower at one end, it has a little slant, and that helps the material to pass along through the screen. Then it is pushed by other material coming in. It is mainly the fact that the axis is slightly inclined, towards the discharge end. It might also be noted that early in 1921, when he began cooling the mill with water, Hall was much troubled by the water leaking into the mill, through the seams, but by the end of April, 1921, this had been corrected. By April, 1921, Hall had reached the point where he was able consistently to turn out lead dust from the Hardinge mill, but to standardize upon the quality, a large number of laboratory tests were required, which overtaxed the existing personnel. In order to meet these needs, Howard Stoertz was taken into the employ of

the research department under Kershaw, in April, 1921, and he very soon began systematically to test the product. Exhibits 48, 49, 50, 51, 52, 53, 54, 55, 56, 57 and 58, show that between March 2nd and April 12th, 1921, the Hardinge Mill was constantly, though not without interruption, producing lead dust, in constantly increasing amounts, and with fewer interruptions. These record sheets are, however, incomplete and difficult to decipher, but with the advent of Stoertz, the methods of testing and recording were very quickly perfected. One of the first things Stoertz did was to work out, under Hall's direction, a rapid method of testing the lead dust for its PbO content. This method was completed by early June, 1921, and Exhibit 59, dated June 6, 1921, gives the essentials of the test, which with minor refinements has been carried out by the mill operators ever since, for control of the Hardinge mills. The test is so simple that it may be performed by a man of ordinary intelligence without any special chemical training, and chemical laboratory tests constantly carried out as a check, have shown it to be surprisingly accurate.

As the main principles of operation were now well understood, and a rapid method of test was available, Hall made out a regular log sheet, shown in Exhibit 60, dated June 14, 1921, and in certain subsequent exhibits, which was used from that time on. The explanation of the headings in this log sheet is as follows:

Amperes—Current used in driving the mill.

Product—Weight of lead dust discharged into a steel drum (keg) placed on the platform scale.

Feed—Weight of lead balls introduced into the mill.

Air—The amount of air flowing through the mill in cubic feet per minute, measured by Pitot tube, which was calibrated by measuring the air flowing through a U. G. I. meter.

Apparent Specific Gravity—Weight of a cubic centimeter of lead dust expressed in grams.

Oxidation—there appears to be a slight mistake here in my copy; the temperature is a record of a recording thermometer, whose bulb is placed midway between the mass of moving balls and the shell of the mill at its largest diameter. The bulb was fastened to an iron rod inserted through the feed end of the mill, this rod being rigidly fastened to an outside support. The temperature of the air within the mill is what is recorded but not the temperature of the lead balls.

There is a heading, "Oxidation", here, which has no explanation in this note, but the oxidation is the figure arrived at by the chemical tests noted above, and giving the percentage of PbO in the product. That is, all oxidation was being calculated as PbO. From June, 1921 on, Hall continued to run the mill practically continuously, varying the product at will, keeping accurate records of its characteristics and making it into battery plates to be sure that it was satisfactory. Exhibits 60, 61, 62, 63, 64, 65, 66 and 67, dated June 14, 1921 and December 27, 1921, respectively, are typical of the results obtained. By controlling the variables, he made lead dust, by this time known as gray oxide, with PbO content anywhere between 44 per cent, Exhibit 62, September 26, 1921, and above 80 per cent, Exhibit 63, August 19, 1921. And, moreover, he was able to hold any percentage oxidation desired within those limits.

Mr. Morris: There may be a correction to make at that point in dates, if your Honor please. May we reserve that right?

The dates you have given, that you gave last, were the dates of Exhibits 61 and 62, and, as I understand it, you want the dates of 62 and 63, but we will correct that.

MR. WHITCOMB: Sure, that is all right, sure.

THE WITNESS: They are all within this range of exhibits that I have quoted here.

The witness, resuming, testified: During all the year of 1921, and more especially during the latter part of the year, the lead dust from the Hardinge mill had been constantly used to make battery plates, and these battery plates had been put through formation and subjected to many tests. As a result of this testing of various lots of Gray Oxide, Hall, by the end of 1921, had confirmed the general conclusion of Kershaw that, approximately seventy per cent litharge content was the optimum composition, and accordingly adopted sixty-seventy per cent as his limits; later further narrowed down to sixty-five, seventy per cent. The figure of sixty-five, seventy per cent PbO content has remained the standard up to the present time.

As already noted, as soon as the Hardinge mill started to produce lead dust in quantity, this material was made into plates, which were then tested by the laboratories. Exhibit 68, headed Special Process Number 5065, was issued by the Department of Development and Design, on April 22, 1921, instructing the superintendent's department, to make certain plates with lead dust, under the supervision of Kershaw. This Special Process Number 5065 was subsequently extended by the issuance of forty-two other sheets calling for additional plates, the last sheet, dated October 26, 1922. Upwards of 3,700 motive power plates, and 55,000 starting plates were made under this Special Process Number 5065, and the tests of these plates satisfied The E. S. B. Company that the material made by Hall—slight error, typographical error there—that the material made by Hall in the Hardinge mill was substantially like that produced by Kershaw in the German type of mill, and that it was perfectly satisfactory to use.

By the latter part of 1922, all the product which could be produced by the Hardinge mill (now known as Gray Oxide) was used in standard plate production, but the quantity available fell far short of the total demand. As a result of this condition, it was decided to erect at the Company's Crescentville Works, a new plant of much greater capacity than the single Hardinge mill already in operation. The layout of this plant was completed January 30, 1923, and Exhibit 69 shows the foundation plan drawing, SE-4125-11, dated January 30, 1923. This plan called for four Hardinge mills, which were accordingly ordered on Requisition L-99581, dated November 24, 1922, Exhibit 70. The building for housing these mills, known as building 17, was erected by William Steele and Sons, and was completed, and the mills installed therein complete, so that in July, 1923, production of Gray Oxide began.

No difficulties, other than of a very minor character, developed in the operation of this plant, and its product was at once delivered to the pasting department and used in the manufacture of the company's regular product.

The mills in this plant were installed in accordance with the experience gained from the original Hardinge mill, and included the temperature recording thermometers, and improved arrangement of air blowers, and bag separators. The air was drawn through the mills in the direction counter to the flow of the lead; that is, the air entered the mill at the trunnion where the Gray Oxide passed out, and left the mill at the trunnion where the lead balls entered.

During the first month of its operation, this plant produced 203,350 pounds of Gray Oxide and during the first six months, that is up to December 31, 1923, it produced 3,602,000 pounds.

The new plant for producing Gray Oxide had hardly been completed before it was realized that it would not be able to supply enough material for the requirements of the manufacturing department. Hence, it was decided, in the latter part of 1923, to increase it. Accordingly plans were drawn up for extending building number 17, this extension to be known as building 17-A; William Steele and Son's drawings dated November 26, 1923, Job 840, Sheet 1, Exhibit 71 and number 850, dated May 12, 1924, Exhibit 72, show this projected building. From experience that had been gained in the operation of the Gray Oxide mills in building 17, it was decided to relocate the four original mills so as to make the whole layout harmonize. The four mills for this new building were ordered January 17, 1924, requisition L-120560, Exhibit 73. The extension was originally planned for two mills but this was changed and the extension was finally put up for four additional mills, Exhibit 72.

Up to this time, air current through the mills had been in the counter flow direction, as in the original Hardinge mill. In October, 1923, the old Hardinge mill, originally installed at 19th Street, was removed to Crescentville and tests were conducted upon it with the direction of the air flow reversed, so as to coincide with the flow of the product. At the same time, experiments with a much larger size of ball; namely two inches in diameter. Both of these experiments proved successful, so that the eight mills of the larger plant were all arranged to use two inch balls and to have the air flow in the direction of the product. The change in direction of the air flow was a matter of mechanical convenience only and had no effect upon the product or the operation of the mills.

The four new mills were erected and put into operation in August, 1924, using the two inch balls, while

the four original mills were still using the five-eighth inch in their old location. The old mills, however, were moved as soon as possible after the new ones were installed, and were in operation again by January, 1925.

For a number of years, the Hardinge Company worked on a scheme of air flotation whereby the dust produced within the mills was blown out of the mills by a strong current of air entering through the trunnion at the discharge end of the mill. The dust laden current of air issuing from the discharge end of the mill was carried through a number of separating devices and there deposited, the air between being discharged to the atmosphere through a bag collector. This plan seemed to have some recommendations, hence it was decided by the E. S. B. Company to try it on the old secondhand mill the first one purchased from the Hardinge Company. Accordingly, this mill was sent back to the Hardinge Company to have a larger trunnion fitted at the discharge end. Accordingly, requisition 2242, dated December 23, 1923, Exhibit 74, was issued to the Hardinge Company, for changing the mill and furnishing the necessary collecting apparatus. When the mill came back, it was promptly erected, with the cyclone, collector, etc., as furnished by the Hardinge Company, and a number of tests were made. However, the operation of this apparatus was never successful, although considerable time and expense had been put on it, and it finally had to be completely abandoned. It may be of interest to note that this mill may still be seen at Crescentville, building 17, when it will be noted that there were never any holes drilled through the shell. This bears silent witness to the fact that from his first inception of the use of the Hardinge Mill, in July, 1920, Hall clearly planned to maintain the necessary oxidizing atmosphere within the mill by means of the hollow trunnions.

During the latter part of December, 1934, it was decided to duplicate the original lead dust-mill which had been used by Kershaw at Philadelphia. A mill of this kind was available at the Willard plant, in Toronto, having dimensions within a fraction of an inch of the older mill, the installation being such that a few minor alterations of casing, et cetera would make it identical. The arrangement of perforations in the drum of the mill, however, was slightly different from that of the old mill, but by boring some extra holes and plugging up some others, which were of a different diameter, the original conditions could be duplicated. These various changes were accordingly carried out, and in the latter part of December, 1934, the mill was ready for operation. The dimensions and all appurtenant data as to this mill were most carefully checked by Hall, Kershaw and Smith, of The E. S. B. Company, and Reinhardt and Lockwood of the Willard Company, with the result that the Toronto mill was found to be practically an exact duplicate in every respect of the German type mill used by Kershaw in his operations of 1916 to 1918. The mill was erected on an elevated platform exactly as was the mill at Philadelphia and a ventilating pipe was installed from the casing up through the roof of the building so as to reproduce the ventilating arrangement of the Philadelphia mill.

Since the object of this test was to duplicate the old mill, both as to the installation and operation, it was put into the hands of W. E. Kershaw to operate in exactly the same way as the old mill, so far as humanly possible, and in order to better enable him to do this, he took with him to Toronto, Benny Shablin, who had helped him throughout in operating the mill at Philadelphia in 1916, 1917 and 1918. The mill was accordingly put into operation, running day and night, and on December 20, 1934, its operation had settled

down to the point where Kershaw was satisfied that its working was exactly like that—

Mr. Betts: May it please your Honor, I hesitate to object, but it seems to me that a large amount of this material that the witness is reading is clearly hearsay and not admissible. If it were by question and answer we certainly would have to object:

I was there during the operation of this mill. We were all satisfied.

The Court: Well, I wonder if it makes much difference what Mr. Kershaw's feelings were.

The Witness: He can testify to that, he is here. Mr. Kershaw is in the room, he will be glad to testify to that.

Mr. Morris: I don't think there is anything there about his feelings.

Mr. Whitcomb: There is one other place, though, he said it was the same thing it was humanly possible to make it, and yet he points out certain differences. There are certain conclusions of the witness going in here that in our opinion get to the patent end of it. We ought to have an objection to all those.

The Witness: I am not aware of having any differences.

Mr. Whitcomb: You pointed out about the stack.

The Witness: I said it was to have it like the other, not different.

(The following documents, heretofore offered in evidence and referred to in the foregoing testimony of the witness, were here received in evidence and marked as Defendant's Exhibits as indicated subject to objection by plaintiffs after opportunity for examination:)

Letter dated December 9, 1916, from G. M. H. to Mr. Hodge, entitled "New York Railways Company", was marked Defendant's Exhibit number 20.

Memorandum from Department of Development and Design dated February 17, 1917, entitled "Lead Dust Positives for New York Railways Co." was marked Defendant's Exhibit number 21.

Letter dated June 21, 1917, from Lesley, of the Operating Department, to Mr. Welcke, entitled "New York Railways, New Contract—Special Positives—Close Ribbed Wood Separators" was marked Defendant's Exhibit number 22.

Letter dated December 1, 1916, from the Manager of Construction Department to Mr. R. S. Garton, entitled "New York Railways, N. Y. Order #70929" was marked Defendant's Exhibit number 23.

Letter dated December 2, 1916, from Manager of Construction Department to Mr. R. S. Garton, entitled "New York Railways, N. Y. 70929" was marked Defendant's Exhibit number 24.

Letter dated December 14th, 1916, from Operating Department, Engineer-in-charge, to Mr. Welcke, entitled "New York Railways Co., New Contract—Deliveries — Special Positives", was marked Defendant's Exhibit number 25.

Record of battery operation in the New York Railways Company was marked Defendant's Exhibit number 26.

New York Sales Order No. 70929, dated 8-7-1916, was marked Defendant's Exhibit number 27.

Letter dated September 19, 1917, from D. W Ross to The Electric Storage Battery Company, and copy of Agreement between New York Rail-

ways Company and The Electric Storage Battery Company was marked Defendant's Exhibit number 28.

Letter dated May 3d, 1918, from Department of Development and Design to Mr. Lesley, Operating Department, was marked Defendant's Exhibit number 29.

First sheet of letter dated May 6, 1918, from Manager of Construction Department to Mr. R. S. Garton, was marked Defendant's Exhibit number 30.

Second sheet of letter dated May 6, 1918, from Manager of Construction Department to Mr. R. S. Garton, was marked Defendant's Exhibit number 31.

Letter dated June 3rd, 1918, from Department of Development and Design to Mr. Lesley, Operating Department, was marked Defendant's Exhibit number 32.

First sheet of memorandum dated June 13, 1918, from Operating Department to Mr. Hodge, entitled "New York Railways Co., Special Positives and Negatives", was marked Defendant's Exhibit number 33.

Second sheet of memorandum dated June 13, 1918, from Operating Department to Mr. Hodge, entitled "New York Railways Co., Special Positives and Negatives", was marked Defendant's Exhibit number 34.

Letter dated July 12, 1919, from The Electric Storage Battery Company to Mr. E. W. Smith, entitled "Lead Dust Mill", was marked Defendant's Exhibit number 35.

Letter dated August 14, 1919, from The Electric Storage Battery Company, to Mr. E. W. Smith, entitled "Lead Mill", was marked Defendant's Exhibit number 36.

Letter dated August 14th, 1919, from Factory Engineer, The Electric Storage Battery Company, to Mr. Woodward, was marked Defendant's Exhibit number 37.

Letter dated October 16, 1919, from The Electric Storage Battery Company, to Mr. J. P. Fitzgerald, entitled "Lead Powder Mill, Willard Storage Battery Company", was marked Defendant's Exhibit number 38.

Blue print entitled "Assembly of Dust Machine", dated October 15, 1920, was marked Defendant's Exhibit number 39.

Requisition No. L59725, dated November 11, 1920, was marked Defendant's Exhibit number 40.

Shipping memorandum of Hardinge Conical Mill Company dated January 7, 1921 was marked Defendant's Exhibit number 41.

Blue print entitled "Layout of installation of Dust Machinery", dated November 14, 1920, S. F. 2427-1, was marked Defendant's Exhibit number 42.

Requisition No. L81510, dated May 5, 1921, and letter from American Blower Company to Electric Storage Battery Company, dated May 5, 1921, were marked Defendant's Exhibit number 43.

Requisition No. L80224, dated January, 1921, was marked Defendant's Exhibit number 45.

Requisition No. L80283, dated April 13, 1921, was marked Defendant's Exhibit number 46.

Drawing No. S-80-A, entitled "'Dust Collecting Arrangement for Electric Storage Battery Company", was marked Defendant's Exhibit number 47.

Memorandum dated March 2, 1921 was marked Defendant's Exhibit number 48.

Chart No. 685, entitled "Bristol's Recording Thermometer, dated March 2 and 3, 1921, was marked Defendant's Exhibit number 49.

Memorandum dated March 4, 1921 was marked Defendant's Exhibit number 50.

Memorandum dated March 16, 1921 was marked Defendant's Exhibit number 51.

Memorandum dated April 8, 1921, was marked Defendant's Exhibit number 52.

Memorandum dated April 9th, 1921 was marked Defendant's Exhibit number 53.

Memorandum dated April 11, 1921, made by Trimble, was marked Defendant's Exhibit number 54.

Chart No. 685, entitled "Bristol's Recording Thermometer", dated April 11, 1920, was marked Defendant's Exhibit number 55.

Memorandum dated April 14, 1921 was marked Defendant's Exhibit number 56.

Memorandum dated April 15, 1921 was marked Defendant's Exhibit number 57.

Memorandum dated April 12, 1921 was marked Defendant's Exhibit number 58.

Memorandum dated June 6th, 1921, entitled "Approximate Method of Determination of PbO in Lead Dust", was marked Defendant's Exhibit number 59.

Daily report of operation of Hardinge Mill, consisting of two sheets, dated June 14, 1921, was marked Defendant's Exhibit number 60.

Daily report of operation of Hardinge Mill, consisting of three sheets dated September 26, 1921 and three sheets dated September 27, 1921, was marked Defendant's Exhibit number 61.

Daily report of operation of Hardinge Mill, consisting of two sheets dated August 19, 1921 and

one sheet dated August 20, 1921, was marked Defendant's Exhibit number 62.

Daily report of operation of Hardinge Mill, consisting of two sheets dated December 6, 1921, was marked Defendant's Exhibit number 63.

Daily report of operation of Hardinge Mill, consisting of one sheet dated October 6, 1921, was marked Defendant's Exhibit number 64.

Daily report of operation of Hardinge Mill, consisting of one sheet dated November 18, 1921, was marked Defendant's Exhibit number 65.

Chart showing operation of Mill, consisting of one sheet, dated September 28, 1921, was marked Defendant's Exhibit number 66.

Chart showing operation of Mill, consisting of one sheet, dated December 27, 1921, was marked Defendant's Exhibit number 67.

Memorandum entitled "Experimental Shop Process", dated April 22, 1921, to Mr. Howard from Department of Development and Design was marked Defendant's Exhibit 68.

Blue print, SE-4125-11, entitled "Foundation Drawing of Four Hardinge Mills to be Installed at Crescentville", dated January 30, 1923, was marked Defendant's Exhibit 69.

Requisition No. L99581, dated November 24, 1922, was marked Defendant's Exhibit 70.

Drawing No. 840, entitled "Plans—Elevations—Sections" dated November 26, 1923, was marked Defendant's Exhibit 71.

Drawing No. 850, entitled "Plans—Elevations, Building No. 17-A", dated May 12, 1924, was marked Defendant's Exhibit 72.

Requisition No. L120560, dated January 17, 1924, was marked Defendant's Exhibit 73.

Requisition No. 2242, dated December 23,

1927, and letter dated December 23, 1927 to Mr. Gold, were marked Defendant's Exhibit 74.)

The witness, resuming, testified: The mill was kept running at Toronto in December, 1934, for approximately three days, I believe. On December 20, it was operated up to the early afternoon, two or three o'clock, as I remember. The material was put into tin cans, which were afterwards carefully sealed and sent back to Philadelphia. May I make a suggestion? On the second run of the mill, where these gentlemen from the plaintiffs were present, the test of the material so produced was done. I wonder if that is not the one you have in your hand. Some of the material made on this first run was sent to Philadelphia in sealed tin cans, was there delivered to Mr. Kershaw and was made by him into plates in exactly the way he had used his former material made in the Philadelphia mill. I observed the results. As near as I can possibly tell, the results were the same as those that were had by the oxide produced by Kershaw in 1916, 1917 and/or 1918. There was a second run of the mill at Toronto made in January, 1935. I have no doubt that is the correct date. On January 11, Messrs. Whitcomb, Betts, Ishimura, Yamoaka, Newton, Wood, Reid, Souther, Wilson, Stoughton, Woodbridge, Kershaw, Anderson, Lockwood, and Hall were present to witness the operation of the mill. They were all in Toronto. I wasn't there. This Toronto mill was not a Hardinge mill. It was a duplicate of the German mill.

Mr. Morris: It was an exact reproduction, so far as we know, of the German mill as used by the Electric Storage Battery Company in Philadelphia in 1916, 1917 and 1918. The drawings of the old German mill, the German mill will show no flue running from the top of the mill, but I shall show you by Mr. Kershaw and by another man whose name I forget at the mo-

ment that that stack, or flue, let's call it a stove pipe in appearance, was put on probably in August, 1916, and our log sheets or some of them will show that in early 1917 the dampers in the flue and the leg, discharge leg, at the bottom were being operated to control the air.

The witness, resuming, testified: A number of the samples taken at Toronto on January 11, 1935, were delivered to the gentlemen representing the plaintiffs. Other samples were sent back to Philadelphia and the material there was used in the making of plates. Dr. Wilson, I believe, also took some samples. The object of this test was as follows. The tests made by Kershaw in 1916 and thereafter were a long way back. Our records as to that material covered specific gravity, oxidation. We had not at that time the means of testing materials which have since then been developed. We wished to get some material which would be representative of that older material, as near like it as humanly possible to make it, and subject that to the modern tests so as to ascertain exactly what this, what that older material really was, and whether it came within the description of the Shimadzu patents.

(Counsel for defendant thereupon offered in evidence as Defendant's Exhibit 75 a sealed tube containing a sample of powder from the Toronto mill bearing Dr. Wilson's initials, which was received in evidence and marked Defendant's Exhibit No. 75.)

THE COURT: Well was this mill commercially operated?

MR. MORRIS: At Toronto?

THE COURT: Yes.

MR. MORRIS: Oh, no, it was set up purely for the purpose.

THE COURT: No, that is what I mean.

MR. MORRIS: No, it was purely for the purpose—

THE COURT: Just as an exhibit.

MR. MORRIS: —of reproducing—

THE COURT: I say, just as an exhibit for this case, really.

MR. MORRIS: That is all, solely. I think it may be that some of the plates that we made—

THE COURT: Well,—

MR. MORRIS: But I don't know that those ever—that we did anything about them.

The witness, resuming, testified: As near as we are able to ascertain, the material obtained at Toronto was almost exactly the same as that produced in the German, in the old perforated mill in 1916, in Philadelphia. Its oxidation was the same, its specific gravity, apparent specific gravity was the same, within the variations that both of the products had, it was pasted into plates, and made plates which were in all substantial respects the same and the equal of those produced in 1916 and 1918. Its features were the same. It was pyrophoric, it would burn, not with very great readiness, but it would burn if you set fire to it with a match. Its fineness, as near as we know, was the same. Everything about it as near as we know is thoroughly characteristic of the earlier material.

I remember of my own personal knowledge that a ventilator, a stack or chimney, was placed above the old mill, perforated mill, in Philadelphia, that we were using in 1916, 1917 and 1918. The stack was placed from the casing of the mill right directly up through

the roof of the building. It was rather a small pipe, small stove pipe.

Cross-examination.

By Mr. Whitcomb:

Practically speaking, all of the testimony that I have just given was of my own direct personal knowledge. I wasn't at the second Toronto test. I did know about it. But I wasn't there. I had direct knowledge in that Mr. Hall, who was there, is my assistant. I haven't direct personal knowledge. That applies to a few portions of the written document from which I read. I know of my own knowledge fifty per cent of it, from personal contact. When the mill was dismantled and sent to Cleveland, I did not accompany the transporting of the mill. I had to do with its being set up in Cleveland only that I furnished directions as to how it should be set up, blue prints. I think I never saw the mill in Cleveland.

(Counsel for Defendant moved to strike out all of that testimony.)

With respect to the mill in Toronto, The Willard Company had this mill in operation. That was not the mill that was shipped to Cleveland originally. This is a different mill. The Willard Company operates the Toronto plant. They also operate the Cleveland plant. They have two plants. This was a mill that they had set up and were operating in Toronto. They operated it in a different way. It required very slight structural changes to bring it in a line with the German (mill). So, to make our experiment, we took the Toronto mill, which was in commercial operation, and changed it somewhat to what we thought was the German mill, to correspond with what we had in Philadelphia in

1916, 1917 and 1918, the German type of mill. In my discussion as to when Mr. Hall entered the field in connection with this Hardinge mill, I talked about the requirements for the air being introduced. I meant by that that it was well known by that time that air was required inside of the drum of the mill to oxidize the balls. Hall filed an application for a patent, I testified in his behalf in an Interference in support of his contest with Shimadzu as to the very issues in some of these claims here before the Court. It was well known that air had to be introduced to make the process work. The amount of air was not very definitely known. Hall introduced the air. I testified on direct that that question of air balance and amounts of air was very important. If you don't have sufficient air, you get a much reduced product and of a lower oxidation. I mean by reduced product, reduced in quantity. If you get too little air, you get very little yield. If you don't have any air, as has been testified here, you don't get any product. I can't tell you what amount of air Hall used in his first installment of the Hardinge mill. I have no measurements of that. I think I did not testify in the Interference that he had enough air to blow the material out. I haven't that before me, but to the best of my recollection that is not correct.

(The Interference Record was here shown to the witness.)

In XQ80 in the Interference procedure, I testified that some of the powder runs out and some is blown out. I was referring to Hall's material. I would have to go back over this Record a little to see just what it is getting at. As to whether that is a correct statement of what I said, it is printed there, it is perfectly clear that I said it. To the question XQ87: "Yes, so far as blowing the stuff through the mill is con-

cerned?", it is correct that I made answer at that time: "So far—yet, that is correct, it is indefinite as to what, how much was blown through, in both cases." It is not my opinion now, that he had enough air to blow some of the material through. Since that time more information has come to me, as we have made tests on this effect of air blowing so we know more about it than we did at that time. Undoubtedly, some comes out with the air, still, if that is what you wish me to say. Where you have a current of air and dust in the material necessarily some comes in the air. It is in no way a vital process of the mill, however. This was the thing that Hall changed over the prior mill, when he introduced the Hardinge mills that I have just testified to this afternoon.

The main differences between the Hardinge mills started in 1920 and the prior alleged installation in 1916, are that in the earlier mill the air entered the mill and left the mill by the holes in the perforations in the drum. I said that Exhibit 15 represented the casing around the installation in 1916. That is the top of the casing in the upper left-hand view. There is no opening through there for air. I testified in the original German mill it leaked. In the original Philadelphia mill it also leaked, until a pipe was put in, a ventilating pipe, to increase and better control that flow of air through the casing. That is what we had in Toronto, and we had at some time in Philadelphia. As first erected, the apparatus shown in Exhibit D-15 didn't have a vent pipe. Kershaw soon put such a pipe on, as he will testify for you. The difference between the operation of the air in the German type of mill, first installed in the Philadelphia plant, and in Hall's Hardinge mill, was that in the original installation of the German type of mill the air flowed up through the casing, out through the cracks. I never measured it,

but I have seen the current, seen that there was a current in the bottom of the pipe, so I know there was a current there due to the heat. There was no fan or forced draft. Hall introduced the air—you asked me all the differences, so I will go back.

One was in the method of getting the stuff out, getting the product out of the mill. The other was the difference in getting the air in. In the original mill the powder came out through the holes, the air went in through the holes. In Hall's mill the powder was discharged by the conical mill, conical part of the Hardinge mill, according to its well-known operation, and the air was introduced through the hollow trunnions, in one and out the other. That is, I mean, according to this conical effect at the outlet end of the Hardinge mill, as shown on the drawing attached to Dr. Wilson's report. This does not have an aspirating or jet effect. The Hardinge mill in general discharges at the lower end without any aspirating effect. It has a cone, narrowing effect; but it has no aspirating effect. The velocity is higher in the trunnion, of course. It does not expand appreciably after it gets in the screen chamber, because it is not compressed. The velocity changes. The carrying power of these particles of dust is due to the fact that the mill is conical, and that the axis of the mill is on a slant, the mill is not horizontal, so every time a particle is carried up on the cone, it is dropped a little further away. I am not saying that no material goes through by reason of the air, but I am saying for the large part of it, while Hall operated these mills, the air went through in the opposite direction and the mill discharged contrary to the flow of air. Now there is no contrary motion in the present installation as shown by the print attached to Dr. Wilson's report. I believe it is correct that in the first Hardinge mill that Hall installed, the air went the

other way. I would have to check very carefully on that. I testified on direct examination that as to the first mills that were set up at Crescentville, it went the other way. In the Crescentville mills originally installed, air was blown through in the opposite direction. Hall put up the first Hardinge mill at 19th Street. When I testified positively, I testified as to the Crescentville mills. I will check up on the first installation. I haven't got the information before me right here. If I can clarify the situation, we have run mills with the air in both directions, at different times. It is probably correct that in the 19th Street first installation of the Hardinge mill, the air went in the counter direction, but I haven't the information at hand other than that. It has been some years since I made any check up on it. My memory doesn't serve me absolutely as to just which way. The air in the mills at the Exide plant now flows in the same direction as the material, as would be the case in the showing on the Shimadzu apparatus patent in suit, except that the internal arrangement is totally different. But the direction of air is the same. The direction of the air in the exit trunnion is the same. In connection with this drawing attached to Dr. Wilson's report of the Exide mill, the screen is also inclined.

Hall was employed in 1920 to work under my direction in the installation, the planning and the building and operating of a larger plant for the making of lead dust. We were satisfied with the output of the machines in the old installation of the German type. We did not continue to use them. Our reasons for discontinuing them were that we found that the Hardinge mill gave us somewhat better control of the process and also gave us better output. The Hardinge mill as at present operated is a much larger mill. I don't know whether I have a basis of comparison of

output or not. I haven't any accurate data as to what the German type mill produced, as operated by Kershaw. That we can get; I don't happen to have it before me. As regards Kershaw's work, Kershaw did not work under my direction and it is correct that I haven't such direct information as to his work as I have with the later work. That applies to these curves I produce, that is Exhibit D-18. Kershaw will have to testify to those curves. Those are Kershaw's curves. He will give you full information on that. I recollect no difficulties experienced with these types of mills that Mr. Hall worked on when he first started the Hardinge installation in the 19th Street place, other than such mechanical difficulties as breaking of belts and sticking of bearings, and the difficulties that are common when new machinery is installed. It naturally took some little time to learn exactly how to operate the mill to control it. I did testify in the Interference previously referred to that I would say that it took, roughly, some six months to eliminate the difficulties occasioned by leakage of water in the Hardinge mill that Mr. Hall installed, if it is in the testimony. It is roughly the case. I have already mentioned that Hall had much difficulty with water entering the mill, this afternoon I mentioned that. The water came from leaks through the seams of the mill and in the manhole. It was the cooling water, to cool the mill. It took us a long time to find that out. I have mentioned that already in this afternoon's discussion. You asked me just now if there were any difficulties other than those I had mentioned, and I had already mentioned the difficulty with water in my previous testimony this afternoon. I did not say in direct-examination that that was a minor thing and immediately overcome. I think I said it took some months. I don't remember. It caused us a great

many arguments and we had a good deal of difficulty before we actually found what it was. It manifested itself chiefly in the formation of a ring of hard litharge on the inside of the mill, and in such a way as to clog the output, so that the stuff did not run out, and it was a long time before we were persuaded that it was water leaking through the seams which caused the formation of these rings, and that, I think, was brought out in the former testimony as well as in today's.

Maintaining the correct temperature is very important. The cooling produced by some external agency is important in that respect. Regarding the reactivity of the material my testimony is not quite to the same effect as Mr. Cooper's was yesterday with respect to material around the plant. The material which we ordinarily make, as standard material, if you pour it out onto a table or anything else, will not burn if you touch a match to it. Cooper's testimony was that sometimes the material direct from the mill while it was hot fell into some drums which were wet, and that it caused steaming. I am not familiar enough with that particular form, with that particular incident, to know whether what he spoke of on that is correct or not.

As to the samples of the 1921 Hardinge mill, the samples were of all ranges of reactivity. Some of them were extremely reactive and others were not, according to how they were made. Some of them would burn very readily when you touched them with a match. Others would not. The composition of our material varied over wide limits, until we finally arrived at the one which we considered the best suited to our purpose.

I have mentioned the formation of PbO. As to whether there was any other oxide made in the operation of the Hall 1921 mill, I can give you a great many

opinions, but when you come to pin me down for direct knowledge, I can give you none. My personal opinion at the present time, in view of many tests that have been made by other people, and whose evidence I am taking is that there was no such other oxide, either inside the mill or as the product came out of the mill. In the interference, I testified that there might be suboxide. Since the date of those tests, there has been a great deal of new light thrown upon it. I wish you to understand that I am giving you my opinion; I didn't say that there cannot possibly be any suboxide in there. I started this question by telling you that I didn't know, I would be glad to give you my opinion.

THE COURT: Well, what did he say in the Interference proceeding?

MR. WHITCOMB: On page 347: "I know that Hall produced it in his mill." The question is:

> "What if any knowledge have you as to the manufacture prior to March, 1924, of lead powder, the contents of which is metallic lead and lead suboxide, the later in major proportion?"
>
> "A. I know that Hall produced it in his mill, in his Hardinge mill, in whatever quality he wanted, made it in large quantities."

The witness, resuming, testified: Do you mind my saying it is now my opinion that there is not any other oxide in it? A great deal of light has been thrown on that subject between that time and this. That is, from the experts I have consulted and those that you have, also. I think the two are substantially alike. My opinion is that they are alike. I haven't the least idea whether or not there is a transformation from one stage of oxide to another in the mill. I have no recol-

lection as to whether I did state that there was in the interference, but if it is written in the book, I no doubt said it.

There may have been glass peep holes used in some of the mills that Mr. Cooper testified about at times. Whether they were there during the time he was there, I have no recollection. At times, we have had glass holes, glass plates, to look into the mills, but they get clogged very quickly and are not very successful, not much use.

The five so-called well-known oxides of lead that were spoken of in Hall's patent, which are given in all of the chemistry text books, up until very recently, if not of today, are lead suboxide, lead monoxide lead sesquioxide, red lead, and lead peroxide. The symbol for the sesquioxide is Pb_2O_3. Red lead is Pb_3O_4. I am not willing to swear positively that there is Pb_2O_3. You asked me what they were. I answered that those are the oxides that are given in the textbooks. I am not going to swear that there is such a thing. There is not any Pb_2O_3 that I happen to know of.

My testimony that the product of the Toronto run was the same as the old product that was gotten in the mill in 1916, 1917, 1918. I will go this far, that the apparatus in which it was made was exactly the same, as nearly as we could make it, humanly possible, that the two pieces of apparatus were run as nearly the same as possible, humanly possible to run them, and, the effect, we had the identical people trying to produce the same—the tests which were made of the product, chemical tests, oxidation tests—I didn't make the tests myself. I know only through these records. As far as my direct knowledge goes, it doesn't extend to the chemical composition of the product, except I have access to the work that has been done. I have to take somebody else's word for it. As far as my di-

rect personal knowledge of that product is concerned, it is limited to the appearance and the way the product feels to the touch, and the weight and so on, the physical characteristics, in other words. That is what I say about this. I don't know of my own knowledge, I don't offer any testimony as to the chemical composition of the product. In answer to your question as to whether I felt it with my hands, I wasn't there the second day of the run.

By Mr. Whitcomb:

Q. You have already testified that you previously testified in the Interference record. Please state whether or not on page 353 of that record in the Court of Appeals the following questions and answers occur:

"Q. If I tell you that the product to which 44 related was related was dark in color, and made by the Hardinge mill operations, could you state in regard to such a product anything about its contents of suboxide of lead and metallic lead, and about the proportions of those substances?

"A. I could, yes.

"Q. Well, what would you say?

"A. An oxidation of forty-five per cent—

"Q. Well, I took 44?

"A. 44 per cent, quoting from memory, corresponds to about eighty-five per cent suboxide.

"Q. And what else, if anything?

"A. And the balance chiefly lead.

"Q. And the balance what?

"A. Chiefly metallic lead.

"Q. What is the meaning of the qualification 'chiefly' there?

"A. Well, there might be traces of oxide, other oxide.

"Q. Such as what?
"A. PbO."

And on page 429, in answer to question XQ99, you state in part: "Now, if you desire to produce a powder containing a large percentage of lead suboxide you must run the mill at a much lower, at a lower temperature, at a suitable temperature."

And again, on page 430, further answering the same question, you stated: "It is also well known specifically that lead suboxide is destroyed and further oxidized if it reaches an elevated temperature approaching the melting point of lead, so to get a large proportion of suboxide of lead you must run the mill at a considerably lower temperature than Hall gives as his limit, as his high limit."

. . . . . .

Q. On page 436, XQ122:

"Suppose you used two hundred and sixty, would you get less suboxide—the other two factors being the same?

"A. Yes—you would get a little less.

"Q. How much less, what proportion?

"A. I can't tell you how much less.

"Q. Well, would it be materially less?

"A. Well, I can't tell you how much less, no, not very materially, I think. When you get up to three hundred there would be materially less."

Then, again, in answer to XQ125, the question was, "Yes"; your answer was: "Control of the temperature is vital."

"Q. Yes. With your experience could you take a Hardinge mill and without experimentation run it so as to get a preponderant quantity of lead suboxide.

"A. Not without some experimentation, I couldn't; with some experimentation I could."

Are those substantially correct

A. I believe they are, sir.

The witness, resuming, testified: I am a chemical engineer. When I testified in the Interference proceeding, I testified from something besides mere guess. I think this answer will clear that up. I am now reading from page 370 in answer to RXQ153. My answer to that was: "You can determine it if you accept the use of the word suboxide as we have been talking about it here, and as all of these tests describe it, that is, of its burning freely in the air, and all of the other tests that have been cited here, make it plain as to what suboxide it is." It is suboxide that I am referring to when I say "Yes", we can make it, if I may enlarge on that a little further. I have no other reference.

By Mr. Whitcomb:

Q. But on page 371, right there, what did you say in answer to XQ158, which was:

"I didn't ask you about tests that you made, but I say those figures of themselves, without the tests, without other tests, would not indicate to you at all how much litharge or how much suboxide is there?"

What was your answer?

A. My answer was:

"Well, I think you make it a little difficult. When I say those figures, without personal background of knowledge, to a person who is not a chemist, they mean nothing; to a person who has studied this problem in a chemical way they mean a great deal. Now, with the background that we have of knowing about this material, they mean a great deal."

The witness, resuming, testified: By the word "we" there, I meant to include myself, and I meant to refer back to the definition of suboxide which I gave a few questions further back. I meant a hypothetical substance which had certain physical characteristics, exactly that. That is as far as I meant to go.

By Mr. Whitcomb:

Q. But you don't deny that you said in answer to the question I read yesterday that you knew that Hall had suboxide, do you?

A. That is written in the record, that is perfectly plain, sir.

I read from some thirty pages of notes yesterday. Those notes were prepared at various times. Going back, some of them, a number of years, and some of them cut down, rewritten, so that the preparation of those has been over a considerable space of time. I was reading from some material that I had written several years ago, that is correct. In reading many of those facts from this paper, I was refreshing my memory, with notes that I had made earlier. I have an independent recollection of most of them. I haven't an independent recollection of everything that happened thirty years ago, or fifteen or twenty years ago. Those notes were not prepared as long ago as twenty or thirty years. I don't know what the date at the top, June 1, 1934, means. If you will show me the thing I may be able to tell you. (The notes were shown to the witness.) I don't know what that means; probably the date this particular copy was made. I didn't dictate that particular sheet. I prepared the notes but I didn't preaare sheet one. If you will let me look at sheet 2, I will tell you whether or not I prepared it. I didn't prepare this particular copy of any of these notes, if that is what you mean. They were prepared

under my supervision. Counsel had something to do with preparing them, and our patent expert, Dr. Woodbridge. I was in frequent consultation with our counsel here, Judge Morris and Mr. Stoughton. They, however, did not help in the preparation to any material extent. I said I didn't prepare this particular copy. I prepared the material from which this is made. I do not know where this sheet was typewritten. I didn't have it typewritten myself. I think sheet 2 was prepared here in Easton, Pennsylvania, but I am not sure. I don't know whether it was or not. I don't know where that particular sheet was written. I don't know where sheet 2 was written. I know some of them were written at Easton. Whether they were all written at Easton I don't know. I can possibly tell. (The witness examined the notes.) This thing has been gone over a number of times, and just where all the pages were prepared, were written, I can't tell you. I don't know where all those particular pages were written. I know that some of them were written here; whether all of them were I cannot be sure.

Q. For instance, on page 9 I see a reference to the vent pipe, the word "small" vent pipe that was supposed to have been installed on the A. F. A. Philadelphia mill is crossed off. Who crossed that off?

A. I don't know who crossed it off.

I don't know whether I read that into my testimony yesterday. You will have to look at the testimony and see. That is my writing. I don't know when I wrote it in—recently, I don't know when.

(Notes of the witness, Smith, entitled "History of the Development of lead dust (later called Gray Oxide) and its use by the Electric Storage Battery Company" were marked Plaintiffs' Exhibit number 42, for identification.)

Referring to Exhibit D-3, those notes, dated August 30, 1907, are in my handwriting. I wrote that on the date given. The process outlined to me was quite new at that time and it was in actual operation. I believe it was satisfactory.

THE COURT: What process, now, are you speaking about, the Hardinge mill?

MR. WHITCOMB: No, the early one he learned in Berlin.

THE COURT: I see, all right.

MR. WHITCOMB: Or Hagen, pardon me.

Perhaps I can help you read my writing. Part of the note states: "It is rather a delicate process and sometimes the product is not controllable at all." I don't know that I can make it much plainer. It was new, and I think, as in all storage battery processes, you sometimes get scrap, you sometimes get some stuff there that wasn't good, sometimes burned in the drums; that fact that some of it, that it is not always all usable, does not to my mind mean that the process was not satisfactory. At times they lost control of it. I said the product at times was not workable at all, they sometimes got a product which they had to discard. I described it as a delicate process. That is correct. In the alleged A. F. A. Philadelphia installation, we had a rotary drum with the balls, the screen around the drum, the casing around that, and a conical discharge shell leading into a pipe that had a long angle portion to it. At the bottom of the pipe it discharged into a drum. (A drawing was shown to the witness.) This drawing, entitled "Plaintiffs' Diagrammatic Sections of Defendant's Alleged Prior Use", roughly illustrates it. As a difference, I may point out that there is far too great an amount of material in the outside screen. (The witness marked the

drawing.) I put an "A". There is far too much material shown at this point "A". Another defect is that there is always a cover at this point (indicating) with some holes in it. Q. Will you mark that B? (The witness marked the drawing.) And, of course, the relative proportions are not accurate. I can't tell you what they should be, I don't know that those angles are all right, these angles and all the rest of that. It is diagrammatic. The lower inclined section was a little longer, I suppose, than that. There is no scale on this drawing. Assuming a scale, it was longer than this, possibly twice as long.

(Drawing entitled "Plaintiffs' Diagrammatic Sections of Defendant's Alleged Prior Use" was marked Plantiffs' Exhibit number 43 for identification.)

There are many details, of course, left out of that drawing, and some of those details I think have an important bearing on the point. That shows a single casing apparently all made of one piece, welded up tight. There are no joints of any kind shown in that casing. Whereas the casing was made according to our blue print with many joints in it. (Exhibit D-15 was shown to the witness.) That is right. There was an opening for the air to escape in that installation that D-15 represents—not at the time it was originally installed. At the time it was installed there wasn't. There was very soon after that. I said there were many seams and cracks. They were slightly open. This note on our own Exhibit D-15, "All seams to be calked", means they were reasonably tight. Thin sheet metal of that kind, it was impossible to get them tight, and if you poured water, inverted that and poured water into it, water would have come running out through the cracks, in spite of the calking. I never did that.

It is a matter of my professional opinion as an engineer. On my direct examination, I said that some of the oxidation took place in this long, inclined pipe, in the space between the screen and the drum. I don't know whether any oxidation took place in this conical funnel shaped discharge portion. I don't know that it took place in the long, angular pipe that discharged to the drum. I can give it to you as my opinion; I never made any test there that would prove it. There is not any more reason why it should oxidize down here in the inclined portion than in this vertical portion. In making this inclined, instead of vertical, straight down to the drum, we copied the German installation. I only know that that is the way they put it up. I installed it, and as I understand it, you are not asking me for my opinions. If you are asking me for opinions and facts combined, some slight oxidation probably took place in the pipe. The inclination delayed the passage slightly.

Q. And permitted the air to act on it, if it was possible to oxidize it at that point?

A. It is my opinion, since that it what I understand you are asking, that some slight oxidation took place in the pipe. I have no idea how much. It couldn't have been much. The air comes in at holes in that cover, which I have indicated there, right near the letter "B". I have indicated the hole there in the cover.

Q. Where is the fan for forcing the air in there?

A. There is no fan.

Q. No fan of any kind?

A. No.

Q. Then what made the air go in?

A. The heat, the natural draft caused by the heat.

THE COURT: Is that identified?

MR. WHITCOMB: Yes. Plaintiffs' 43.

THE COURT: All right, so that it appears.

By MR. WHITCOMB:

Q. Then the air was supposed to go up and the material down, they were travelling in opposite directions?

A. It did do it, sir, it wasn't only supposed to, it was found to do so.

I never measured the air. Assuming the mill is just starting out, the heat is obtained by friction of the balls. Not in any other way until oxidation begins. Before oxidation begins, the heat in the ball drum would heat the air. That would cause the air to circulate. This top of this ball drum is all full of holes, the same as the bottom part. It would tend to start a circulation in and out of the drum, in some holes and out the others. Some of the bottom would be covered by balls, undoubtedly. That would stop up some of the holes to some extent, not entirely, however, because the balls themselves are porous, and the air would be able to come up through the holes and through the balls. The balls do not entirely prevent the air from circulating through the mass of balls. The air would go out the top and in the bottom, there would be a circulation of air through the drum. The air would presumably be going up through, sucked into the drum at that point (indicated by counsel). When you ask whether it would have a downward component at that point, some halfway down from the middle, you are asking very speculative questions. I don't know whether it would or not; I should not expect it to have a downward tendency. It might, the whole interior of the casing when the mill is revolving, the air is stirred up there pretty generally, and exactly what direction the different currents take I am not able to tell you. I don't remember how much

percentage of oxygen there is in air. It is in all the textbooks. I think it is about sixteen per cent. The rest is chiefly nitrogen. Some eighty per cent might be nitrogen and some sixteen to twenty per cent oxygen. That is approximate. And there are other inert gases. There was no drawing ever made of the small pipe, as it was called in my original notes; or stack. I haven't any drawing. I don't know the date when it was made. I think there is a later drawing showing it, but there was no drawing made at the time it was put in. I think the later drawing can be produced. I think it will be produced in Mr. Reinhardt's testimony. We have no drawing, if I may clarify that question. I have no drawing that shows that pipe installed on the Philadelphia mill, if that will clear your question. I did not mean that there was a drawing for the alleged replica made in Toronto.

I don't know whether I have a record of the yield produced in pounds of powder per hour from the alleged A. F. A. Philadelphia installation. (The witness examined his notes.) I don't know without looking at the sheets. I know I have such a record. I have a general recollection it was somewhere in the neighborhood of a hundred pounds an hour, but I am not sure that that is accurate at all. It wasn't much less.

Defendant's Exhibit number 18, is Kershaw's test, dated 8 20 to 8 26, 8 20—26 16. The yield per hour was about forty pounds. On the next sheet, the maximum was about the same—well, a little higher, something like forty-five. Each of these sheets represents a week. On Exhibit D-18, we have at times only thirty-five and just past forty pounds per hour. That is right. The next sheet is about fifty-five and the next one about fifty-five. That is the last of these sheets. I don't remember what was the yield in the Toronto replica. I haven't got the notes before me. I wasn't

there the second day, the second time it was run. At the time when the plaintiffs' experts were there, I was not there. I do not have before me the data on the other mills for the same period as this Exhibit D-18. It is probably here in the room somewhere. There was one mill at Philadelphia of this kind. I can tell you how much lead powder was produced during the time that the mill was running. This first sheet does not cover a week. The mill wasn't running for a week. I said the sheet covers a week, but the mill wasn't running all the week. If you multiply the forty, it is about forty pounds per hour, if you multiply that by the number of hours run, that would give you the production during that particular week. I don't know how many pounds. (The witness made a calculation.) As I see that the mill was in operation about four and a half days during that week, twenty-four hours a day, a hundred and eight hours, I believe that is, and it was doing about forty pounds an hour; made some four thousand pounds during that time. I can't give you any idea of the total amount of oxides required by Exide during that week, in their normal business production. I haven't any idea of the order of that at this time. If it will help you, it was much more than this, of course. I don't know how much more. I haven't any estimate at all. I can't remember that without figuring back pretty carefully. That has been a good many years ago. Conditions have changed very much. It was back in 1916. I can't give you any guess on that figure. Naturally, that mill did not supply all the requirements of Exide during that week. We had to purchase a lot, unquestionably. We were certainly not using anything approaching four million pounds a week. I haven't any idea of what we used in a week at that time. I don't know how much it was and I'm afraid you can't find it out, can't find out from me something that I don't know.

MR. WHITCOMB: Of course, if Your Honor please, he got records of all kinds when he wanted to testify on direct, you see.

THE WITNESS: Undoubtedly—

MR. WHITCOMB: I think they are put under a rather unusual position.

THE COURT: Well, how do you mean?

MR. WHITCOMB: Well, I mean, you see, when we ask him something specific we can't get it.

THE COURT: Well, surely, you can draw any argument you want from the fact that he won't give you any estimate—

MR. WHITCOMB: Yes.

THE COURT: —on that.

MR. WHITCOMB: Yes.

THE COURT: It is a proper matter to argue.

I do not know accurately about the present time requirements. It would take a good many mills of that kind, producing forty to fifty, or even the maximum, fifty-five pounds an hour, to supply Exide's normal requirements in any one week you want to pick in 1935. It certainly wouldn't take a thousand. (The witness calculated.) You asked me how many mills it would take to supply present needs of this kind. (The witness made a calculation.) I would say not more than a hundred, probably less. It would probably take less than that, I would feel. My guess is that it would take less than a hundred mills, and probably a good deal less. I can't give you anything accurate on that. I haven't got the accurate figures in my head and I can't quote you accurately.

On rare occasions, we do let people in to see these

mills in the plant now. That has been the practice of our company for some time. There was no payment made for this particular information obtained from the A. F. A. I can explain that to your Honor if you care to know. We have an arrangement with the German company by which they have access to our plant and we have access to theirs, plant and manufacturing details. I doubt if they would let you in the plant in Philadelphia. Well, I don't know, maybe after all this we would.

The plates that were alleged to have been sold to the New York Railways Company were the size that is known as our MV, 8 5/8 by 5 3/4 by 3/16 thick. They were storage battery plates, larger than automobile storage battery, about twice as big. The size of automobile batteries varies a whole lot. As to the one that is in evidence, you can tell by taking a rule. These were about the same width, 8 5/8 high, which isn't quite twice as high as that. But the plate of course was thicker, about twice as thick, so that all together the plate, I would say, weighed about three times as much as one of those. (The witness referred to Plaintiffs' Exhibit 33). I believe the order was for seventy sets. (The witness referred to the order.) It is in the exhibit, I think it is seventy. This order calls for seventy sets. The storage battery company furnishes on order whatever it chooses; there were no specifications as to what it furnished, covering the material and the detail of manufacture. I don't know whether the New York Railways Company knew we were making these plates from this material or not. I expect they did. I don't know that they did. I believe this material was used in the positive plates only. The number of cells per set that I have given in my notes I think was fifty-eight—yes, fifty-eight cells. As to how many plates were called for in that order of seventy sets, that is in

my notes that you have. I made that calculation. I did not make it for the seventy sets. 56,840 positive plates would be required for that total quota of seventy sets. Of negative plates there were a little more than that same number, 15/14 of that, 1/14 more than that, whatever that comes to. There were something like 105,000 plates, of which 16,000 were made of this lead dust. The production of these plates was authorized in the regular manufacturing department. A number of other departments had something to do with their authorization, as they had with all standard plates. All plates are manufactured according to instructions from the D. and D. Department. That is the Department of Development and Design. All plates are made under their direction. All plates are made according to their specifications. We have day by day control of production of regular plates by inspectors through the factory, following the manufacture. The inspectors come under my department for regular production work. I have no figures as to the relative time of formation of the plates for the New York Railway made by the lead dust, as compared with the time of formation of other plates. As far as I know, it was about the same. I don't know whether it was longer or shorter. I cannot find out from any information I have. The information can be obtained but I haven't got it here. I cannot supply it before I finish my cross-examination. It can be gotten before the case ends. The amount of current required in the formation of these plates, as compared with other plates was substantially the same. I can't swear it wasn't more or it wasn't less but I can swear it was substantially the same. I haven't any figures on it. I will get the figures for that. Let me get that down exactly, length of time and the current. Do you want those figures compared with the standard, corresponding to the amount of corresponding materials and standard—

Referring to Defendant's Exhibit 29, I think it is correct that the batteries supplied to the New York Railways, were not referred to as "test batteries". I don't find it in here yet. Perhaps it is here. Looking at the first line of the third paragraph, it states special positives and negatives. That is correct. I don't know whether I have the data as to when we started delivery of the first lot of seventy batteries for the New York Railways. As far as I know, these are the only ones that were sold during this period of 1916, to 1918, made by this A. F. A. installation. It can no doubt be found when those were first shipped from the factory. I have the back of Exhibit 27. I don't know whether it is exactly the question Mr. Whitcomb wants, I am not sure. It tells when the varieties of that battery were shipped. Whether we can identify these particular ones, I am not sure. This record which I have before me shows that all—I think it is all seventy batteries had been shipped by May 17, 1917. The delivery began in November, 1916, but it doesn't show, as far as I see now, just when these particular lead dust batteries were shipped. It couldn't have been prior to the end of 1916, November. In Exhibit 21, which I introduced, there is an order to "Stop making lead dust plates", issued February 17, 1917. That is correct. I never operated the lead dust mill myself. These New York batteries were the only ones that were sold, as far as I know. That is, represented the only commercial production of that mill. There were twenty-five sets of test batteries all together. That is, twenty-five batteries. There were 16,000 positives in the first set and 3,000 in the other, I think. I will have to look at my notes. They were good sized batteries, each cell having twenty-nine plates, and there were fifty-eight cells in the battery, for operating street-cars. The Department of Design very frequently gave in-

structions similar to our Exhibit 29 in the customary practice. In use, you have a lot of plates that go through, of course. But we have some specially made like these. In this particular instance, these particular batteries were made under a special classification. In fact, on the first line of the second paragraph of the exhibit, they refer to them as special positives and negatives.

As to when the A. F. A. mill at Philadelphia was dismantled, I can only give the dates at which instructions were given for dismantling. I don't know exactly when these instructions were followed out. That was in the summer of 1919. I think it was followed out reasonably promptly. For instance, I find a letter of August 14, "Please be advised that Mr. Speed has completed the dismantling of the lead powder mill. . . ." That was August 14, 1919. There is nothing in our records that shows the basis upon which the payment was made from Willard for the dismantled mill. I think it is referred to here somewhere. Looking at the exhibit, I see "This price has been determined upon quotations made to us on the current cost of replacing this equipment." This doesn't indicate anything particularly to me as to the relations between the Willard Company and the defendant at that time. Our company controls the Willard Company now. They did then. In the meantime, in 1917 and 1918 and 1919 the company was purchasing the bulk of the oxides used by the plant.

I referred to this large drawing, SE 2300, Exhibit number 39. It was dated October 1920. We never made the mill, that's right. There was no note on this drawing that I see there which refers to the holes in the mill. The mill was never made. They were proposed. We abandoned it before we ever made the mill. This drawing doesn't show anything about the

air inlet, of course. There were to be holes in the mill, in the shell. There were no means of introducing air other than the holes. This is a replica of the German mill, except longer, as I described in my notes. The diameter, I believe, was to have been the same, but the length was longer. There is no casing shown here at all. This does show the casing, I believe. There is no stack shown on this drawing. In the right-hand figure, there is a continuation to the discharge affair. The casing is shown. Then that discharges into that close screw conveyor. Moves the material, if any made, supposedly over to the discharge affair. Now, it is shown in this drawing, an opening in the casing, at the point 8. I don't know whether that is a manhole or not. The material is to be introduced in this mill through one of the hollow trunnions. There is no chute shown for introducing—this is not a one batch process. I know that because I helped to design it. I worked on it, and it was designed under my direction. I can't tell without looking at the detailed drawing whether number 8 is a manhole as you suggest, or whether it is a vent pipe. There is nothing on the drawing which says. The mill was never constructed.

My next reference, in order of time, is to the Hall activity in 1920 and 1921. We had never constructed any Hardinge mill or used it for that purpose, when that was started. At that time the Hardinge mill was one that would be very successful with the grinding operations, and it was thought by Hall that it was adaptable and eminently suitable for that process.

Q. Did you in your process utilize the grinding process rather than the tumbling of the balls process?

A. No, that is hardly a fair statement. We did use a grinding method in both mills, cylindrical mills, we used the grinding before the oxidation of the surface of the balls.

I don't know whether the Hardinge mill had been used with the forced draft at that time or not. I don't know whether or not the ordinary Hardinge mill had any means for introducing air, blowing air into the drum, at that time. In any case, the Hardinge mills were using the wet grinding, but I think not always. The means were always there. They had trunnion openings at both ends. Just how often they used air in there, I don't know. I have seen some of Hardinge's patents. I don't know whether I have seen that one or not. (The witness examined the paper, Hardinge patent 1,450,289). I don't know whether I have ever seen that one or not. I know Hardinge has used air currents. That is the Hardinge patent. I will read the paragraph beginning at line 34 or '5. "One of the principal objects of the present invention is to provide a method of and apparatus for aiding the above described inherent classifying action of conical mills. Stated somewhat generically, the invention comprises employing the conical outlet or a portion thereof as a conduit through which a current of elastic fluid is directed toward the outlet opening from the inside of the drum." Hall proposed to allow for circulation of air through the holes, trunnions. He did not at first believe that the fan was necessary. He felt that he did not get enough circulation from those natural causes, and then supplied a fan to it. We use a fan now. We don't run the Hardinge mill now without a fan, certainly not preferably. We think we would get the production we need if we used the chimney, but you need to get a current of air through there to get the oxidation. We use a fan. It is true that it requires more air than will naturally circulate. This particular patent states: "It is important, for various reasons, that the material be removed from the drum with the utmost dispatch as soon as it is reduced

to the desired degree of fineness." That is not important in Hall's process. "Some of the more important of these reasons may be stated as follows:" and so on. "any fines within the mill are so much dead weight and increase the power required to rotate the mill." That is true of the Hardinge mill, if they were not removed, but if I may enlarge on that for a moment, the air is not at all necessary for removing fines in Hall's process. I don't know whether it was necessary in this Hardinge patent or not. I had nothing to do with this patent. I am not responsible for what Hardinge did. He found in certain of his work it was desirable to blow the air out. We found in ours it was not necessary. We collect a little of the material with the cyclone collector or bag collector now. About one-twelfth of this material we get from the cyclone and bag. I have no doubt, as Dr. Wilson's report states, that we used the monogram number three fan. It looks to be a correct catalog for that fan.

(Counsel for plaintiffs thereupon offered in evidence a catalog headed "Sturtevant Monogram Fans" marked "Bulletin Number 337", which was received in evidence and marked Plaintiffs' Exhibit number 44.)

I do not see any mention of three oughts, I see one and two oughts, I don't see any three oughts. That is a much larger fan. These are the smaller ones down here, (indicating), if I am not mistaken. I understood you to say three ought fan. I haven't any idea of the size fan we use now. The fan shown in here is number 3 Monogram Fan. I don't know what the rotation of the fan is. If Dr. Wilson states in his report that it was about twenty-six hundred, I will have to take Dr. Wilson's figures for that. The maximum number of cubic feet per minute that the number

theree Monogram Fan operated in the neighborhood of twenty-six hundred r. p. m. will cause is given in this table as two thousand. The minimum is zero. At twenty-six hundred r. p. m. the maximum is 1580—1780. At twenty-six thirty r. p. m., the maximum volume which appears to be given in this table is 1780. The minimum of course is zero. I thought you asked me what was the minimum that they found it would supply. Well, the amount of air the fan will pass depends entirely on the conditions under which it was working. Under the conditions illustrated on that sheet under the calculation of the number three Monogram fan, there was no minimum given. 1780 is given there as the volume which it will pass at a static pressure of six inches but under a static pressure of nine inches in the column below the horizontal line, it gives less, twelve hundred. I am reading r. p. m., 2630 static pressure of nine inches. For the 2630 there is given one thousand. For the static pressure of one inch it gives 2540.

According to my testimony, Mr. Hall or somebody at the plant ordered a new blower on May 5, 1921, 1920. I have the exhibit that shows the order for that blower. It shows "One three ought type P blower with a direct connected 110 volt D. C. motor complete without motor control. Speed 3400 r. p. m." I don't know what the capacity in cubic feet a minute of that fan was, unless it is stated here somewhere. I think it says, "With the system reduced for connection to gas meter, as you suggested, this outfit should easily deliver two thousand cubic feet per hour."

Referring to my duplicate notes which have been marked Exhibit P-42 for identification, page twenty, I did not list the air twice when I was talking about the early Hardinge mill. I made a separate heading for air. I enlarged on each of these three things, or,

at least the first two of them, by separate paragraphs. The heading for air was not underlined as the others were. Then Mr. Hall ordered this fan capable of producing two thousand cubic feet per hour. We used other fans later on. I don't know whether that particular fan was changed on that mill or not. This first Hardinge mill was the same size as the others. I forget whether it was twenty-two inches by six feet. It is on the record here, five feet by twenty-two inches. It is just the same as the others that are now in use. I haven't got a copy of Dr. Wilson's report, so that I can't check that up. They are all the same size.

Referring to the first temperature charts that we introduced at the first Hardinge mill, Exhibit 49, that shows under date of March 2, starting up from a cold mill, the temperature finally reached a maximum of slightly above 175—177, and on the next day, March 3, it shows a temperature going as high as a little above 190, at the maximum.

You refer to Dr. Wilson's report, Exhibit 20, in which he gives a dimension of the mills as six by nine feet. I still stick to my last few answers about the size of the mill. I would like to refer to some of the other sheets which I think will confirm it, and I think the apparent discrepancy is due to the fact that Dr. Wilson measures the length of the mill over all, and, supposedly, the diameter, whereas the Hardinge Company estimates it by the length of the conical part and the diameter of the conical part, the diameter of the flat part. The cylindrical part in these notes is twenty-two inches long, the total length of the mill from end to end is, no doubt, as Dr. Wilson states it. The diameter there appears to be a slight diversion between the two. I wouldn't care to give the length of the drum of the first Hardinge mill, I don't know. Of course, the length of the cylindrical part of the drum

shows twenty-two inches. I don't know the length of the whole drum, including the two cones and the cylinder, but this is according to Dr. Wilson's figures. This cylindrical part is twenty-two inches long, and that is the way the Hardinge Company rates the mill, the length and diameter of that part (indicating). The original mill, to the best of my recollection, is exactly the same as all of the later ones in the main dimensions. That can be verified, if you so desire. I think they are identical. I happen to be wrong about that. I find on one of these later requisitions, the newer mills were six by twenty-two inches. I still don't think it is right. It appears from these records that the first mill was five feet in diameter, later ones six. I still think they were all the same, but I may be wrong. The total over all length of the drum itself was approximately the same in all, twenty-two inches.

Coming back to the question of temperature control, they do not heat the air before they blow it in. Dr. Wilson's report that the heat of the contents of the mill is produced exclusively by chemical reaction and friction is correct.

Q. What is the control—

A. There is excessive heat generated in the mill, and some of this heat has to be taken away by the water which is put on the outside of the mill. The rubbing and the chemical action together takes it up to three hundred Centigrade. We just put the dry balls in the mill and revolving them generates that much heat. It will melt the contents completely, if you don't cool it. It generates more heat than you need. You have to cool it, at a very slow rotation. The air given is at room temperature. Inside the drum it may be upwards of three hundred. You have the cooling effect of the cool air coming in as well, just as the air you blow in the fire may cool the fire. It would not

have that effect if you blew it in all the time. It would probably heat it more by chemical action. If you blow air in a fire it will cool the walls of the furnace. The material itself is what we are interested in, the melted lead balls. It won't cool that, but it will cool the structure you have the fire in. It will also contact the material, subject the material to a difference of temperature of 100 degrees when it first contacts the material in the drum.

Q. We are talking about the control. Will you refer to Defendant's Exhibit 66 and state when that was obtained and how would you characterize the regularity of the temperature and the control of the temperature during the run illustrated in that chart?

A. Chart 66, Defendant's Exhibit 66, bears date ninth month twenty-eighth, 1921, shows during that interval between then and the early part of 1921 the control of temperature had been very much perfected. That more or less smooth curve around there indicates that we were able to hold the temperature accurately. The curve in Defendant's Exhibit 49 as compared with the character of the curve shown in Exhibit 66 shows in the first place a lower temperature in 49 and in the second place that the control of the temperature was not so accurate. The date of the run of Exhibit 49 was March 2 or 3, 1921. These two exhibits show that between March, 1921, and September, 1921, with respect to the operation of the mills, insofar as uniformity of the temperature is concerned, that Hall had acquired the necessary skill to operate his mill. It didn't take quite that long. He had it going pretty smoothly before that. I don't know if I have any record that shows it exactly. By June he had it going pretty smooth. He did not get a curve for June, but I have records—if you will turn to Defendant's Exhibit 62—the one I have doesn't show the vari-

ation from 190 to 150. I am looking at 61. It is Exhibit 60. Excuse me. I referred to June. It is Exhibit 60. In June he had obtained a more regular control and was getting a more uniform temperature. Referring to the exhibits with respect to the Hardinge mills in 1921 or 1920, on the subject of the load, you want the first reference to the load, the earliest reference, the earliest reference that I have to the load. The one that shows the smallest amounts of load in the Hardinge mill. Exhibit 51, March, 1921, shows, according to my interpretation, that the mill was started with 7882 pounds of balls. They continued to add balls, and the first note of any discharge from the mill is twelve o'clock, after which they added one, two, three, four, five, six—they had added a lot in weight by that time. Apparently, they had added fifty-eight hundred, before there is any note of anything coming out of the mill. As shown by our exhibit 61, the loading that took place in September, 1921, is marked nineteen thousand pounds, in sheet number one—9-26. I don't know that the maximum in March was about twelve thousand. I doubt if the maximum is given. I find that the bottom of the second one of those sheets, the third month, sixteenth, an addition of two figures which comes to 15,382. I take it that is the amount of charge that was in the mill, and I see no notes on either of those pages as to what output they got, other than that they were discharging lumps ring-formed. The mill was not running satisfactorily on that day, certainly, because it says they shut down, placed washers under the bolts to stop the leak. I can't explain definitely a reading on Exhibit 60 of .05 and .06, and I note that, at the bottom, about nine cubic feet, whereas on Exhibit 61 the readings on the first page indicate .95 for the air, other than to say in those readings there seems to have been some confusion on the

second sheet. I mean the first sheet, I mean the sheet dated ninth month, twenty-sixth, 1921. That is defendant's Exhibit 61. And at the top it is marked Sheet No. 1, and in white, 39. There appears to have been confusion in taking down these air readings, because some of them are .05 and some of them are .5. I can give no other explanation. They may have changed the pressure, changed the flow of air, or there may have been discrepancy in putting down readings. One reading .5 would not be ten times more than .05. The velocity of air is not proportionate directly to the pressure. The ratio is square root I think. It would be much less different, and if you will notice the further pages, they all refer to .05, so that I think that there is some confusion there as to that amount of air. Referring to Defendant's Exhibit 61, the last page, dated ninth month, twenty-seventh, 1921, he was getting 370 pounds an hour between six and seven P. M., before the air was shut off. At six o'clock 350 pounds were taken off and an hour later, seven o'clock, 400 pounds. The air was shut off at seven. The next time reading is seven. It looks like another 100 pounds was taken off at seven. It couldn't be seven-ten.

THE COURT: What is the date of these operations he is talking about now?

MR. WHITCOMB: 1921.

THE COURT: That is the Hardinge mill?

MR. WHITCOMB: Yes.

THE COURT: Yes.

MR. WHITCOMB: This shows the difficulties encountered and what happened, and this is an interesting one to show what happened when the air was shut off.

The witness, resuming, testified: At eight o'clock,

after running an hour, only thirty pounds were taken off. That looks right. Shutting off the air and the fact that they added no more balls after seven o'clock, very few more balls after seven o'clock, had a decided effect on the operation. They fed some balls at seven. At six they fed 350 pounds. Then for that charge of 350 at six, with the air on, they drew off 400 pounds at seven. That is right. And at seven o'clock they fed another 400 pounds of raw material and yet drew off 100 pounds at some time, looks to me like seven. Well, at seven that would certainly have come from the previous feed, and then until eight o'clock the only product produced dropped right down to thirty pounds. That appears to be correct.

The specific gravity listed on this exhibit I have in my hand, Defendant's Exhibit 61, is not the true specific gravity, it is the apparent specific gravity. That means the specific gravity of the loose material, not packed. The specific gravity of lead itself would be 11.34, if I remember. It is relatively heavy. And this is two. It is obtained in several ways. One is to take a small, known volume crucible and let the stuff drop into that and then skim off the top. You let it pour in at no particular rate, just pour it in by hand. A somewhat refined method is that known as the Scott volumeter, where the lead is also poured down on to a small vessel of known volume, and then it is cut off straight at the top and weighed. There is no mechanical shaking in that. It is just poured by hand. It goes down a series of steps, so as to get thoroughly distributed, and broken up, in dropping down. The steps are about an inch apart, I think. Pretty close. The fall is something like this (indicating) zig zag. I don't know how many steps you have. It is a perfectly well-known instrument, you can easily verify exactly what it is. That is not the only method we employ. I don't

know which of these this exhibit refers to. Both methods are reasonably close in results. I think this one refers to the first method, because when it is expressed in the Scott volumeter it is not expressd in the same terms, and I think, therefore, that this one was made by pouring it into the crucible. I believe that was entirely done by hand. You have no gauge at all, it is like filling a teaspoon to overflowing and then scraping off the excess.

Referring to Defendant's Exhibit 54, we started at eight A. M. and shut down at 10:50 for repairs. Started at 1:05 P. M. Before that the disc at the discharge end caught in the screen. I am not quite clear as to what the disc is to which it refers. The screen is perfectly plain, the screen is the rotating screen sifter which is attached to the end of the mill, and this screen—this disc which I am not clear about, caught in the screen, probably tore a hole in the sieve. Then in the afternoon, the motor was out of order, screw conveyor motor was out of order. That test was in April, 1921. Turning to the test of April 15, 1921, which is shown on Defendant's Exhibit 57, they were running into troubles with the ring forming inside the mill. It is formed from the product, the oxide. It clogs the mill and prevents it from discharging, and stops its operation, very much impedes its operation. Defendant's Exhibit 57 also speaks of the dust burning. There are several instances of the formation of the ring in Exhibit 57. I see only the one of the dust burning. About the reference to the dust burning, I have only got to the first page there.

In my notes marked for identification Plaintiffs' Exhibit 42, page 11, I refer to this as an experimental manufacture. I don't know whether I am there referring to the installation of the first 1916 mill or not. The word "experimental" is used there. It is under-

scored in pencil. That is correct. Then, again, on page 16, for a second lot of plates in the order for the New York Railways, I think I refer to it that it was decided to make a further "demonstration of the lead dust positives". Then, again, on page 13, I refer to these first cells as being put on test on August 16, 1916. That is correct. That is a laboratory test. They are the laboratory tests I referred to in my direct testimony. I don't know whether I have stated definitely in what year and what month Hall had his type of apparatus working to the satisfaction of the company at the earliest time. In the notes, I implied that by the middle of 1921 he had got most of his mechanical difficulties straightened out, and from that time on was able to produce material satisfactorily.

Q. Well, you speak of mechanical difficulties, they are all these difficulties you have been testifying about in comparing the different charts in April and August and September, are they not?

A. Yes—what is that?

Mr. Whitcomb: Read the question.

(The question was repeated by the Reporter, as follows:

"Q. Well, you speak of mechanical difficulties, they are all these difficulties you have been testifying about in comparing the different charts in April and August and September, are they not?")

By Mr. Whitcomb:

Q. That is air, temperature control—

A. Wait a moment, now, the difficulties we were speaking about were the formation of rings and the mill burning. That was in April.

Q. But this morning you also testified about the

lack of uniformity of the temperature charts for the early days, did you not, as compared to those —

A. As compared to the later ones, yes.

Q. And the same with respect to the feed and amount of material and product produced?

A. I don't remember testifying anything about that this morning.

Q. This afternoon, I mean.

A. I would like to get a little clearer your question. It isn't quite clear to me what you are getting at.

Q. Well, as I understood it, for example, in many of these sheets you produced, say, in March and April we have questioned about these difficulties they show?

A. That is correct.

Q. Whereas the latter tests, around September, and so on, show a much more satisfactory operation, is that—

A. That is correct.

Q. Is that correct?

A. Yes, that is correct.

Re-direct-examination.

By Mr. Morris:

I agree with Mr. Ishimura and Dr. Clark that no product in the way of powder will be obtained from rumbling lead balls in a rotating mill in an inert atmosphere. That is, if you have no oxygen present, you get no product. We got a product with the mill installed in Philadelphia at 19th and Allegheny Avenue. It becomes obvious from that fact that air was entering into the interior of the drum. From the fact that we continued to get a product, it is perfectly obvious that air must have continued to get into the drum.

THE COURT: Are you speaking of what we have called the A. F. A. mill?

MR. MORRIS: A. F. A. mill, 1916 and 1918.

19th and Allegheny Avenue is the location of the office. That is it. And Crescentville is the location of our present plant. The first Hardinge mill was installed at 19th Street, the same place as the original German mill, not the building, but the factory, the same general location. We certainly got a product from the 1916-'18 perforated drum installation. The product was a porous mass of particles. It was reactive. Much of it was spontaneously converted into litharge by merely exposing it to air. That also started if a drop of water was put on it. If a lighted match was applied to it, that started burning. The oxidation continued until it had gone all the way through. In some of that product of the 1916-1918 mill, of the lower oxidation, all of those properties were present. In the higher oxidations the reactivity with oxygen was very much less, so that some of it of the higher oxidation would not burn when you put a match to it.

In my testimony I specified that we had put as many as eight mills in the Crescentville plant, but I didn't limit it to that. There were two more after those that I mentioned, to make ten altogether, including the old mill, the old, original mill, which has since been moved up there. I spoke of the defendant controlling the Willard Company. That is by stock ownership. In my cross-examination I said that more air was needed than is obtained by natural circulation. That was applied to the Hardinge mill. That is right.

The effective capacity of a fan is affected by the conditions by which it is surrounded. A fan

will maintain a certain—at a certain number of revolutions will give you a certain maximum pressure. The pressure produces a flow of air through the delivery system. The amount of air so delivered depends equally upon the pressure supplied by the blower and upon the resistance of the system into which it is blowing the air. For instance, if it is blowing through—if the fan as big as this easel here were blowing into a pipe as big as my finger it would deliver an extremely small amount of air, even though the fan had a high rating, and a fan is not what is called a positive blower, its delivery depends entirely on the resistance to which it is delivering this air. Any fan, no matter how big, if the air pipe is shut off will stop delivering. Notwithstanding it continues to rotate.

On cross-examination I was asked a few questions with regard to the quantity of air passing through our mill under given conditions. I have read the patent 150.

Q. And I call your attention to the only places that I can find with regard to air in that patent. The first one is line 11, 10 and 11. I call attention to line 11, 10 and 11, which say introducing into the vessel while slowly rotating air or any gas containing oxygen. Do you find in that statement any rate of introducing the air?

Mr. Whitcomb: If your Honor please, of course, this witness was not asked anything about the patents on direct.

The Court: No. He wasn't, and isn't it all a matter of argument, anyhow?

Mr. Morris: I think so, I can make my point by a statement of mine at this time, rather than

further examining the witness, and that is that I find nothing in any of the patents which shows what the relationship between air or these other ingredients is.

THE COURT: Well, that will be a matter—

MR. MORRIS: Yes, I thought your Honor should have that in mind.

THE COURT: All right, any time.

MR. MORRIS: That is all.

MR. WHITCOMB: Well, of course, your Honor,—

MR. MORRIS: Oh, just one—pardon me.

MR. WHITCOMB: What I was going to say, of course, we have presented the testimony of our Dr. Clark and others as showing what that same patent discloses with respect to air.

THE COURT: Yes.

MR. MORRIS: Well, that is all I want to call attention to, my point is there, good or bad.

The witness resuming, testified:

I testified that the old mill in the 1916-18 installation in Philadelphia was shipped to the Willard Storage Battery Company, at Cleveland. It was shipped back to the Electric Storage Battery by the Willard Company. Then it went into a storeroom which we have for putting in a machine that is no longer used. It stayed in that storeroom for an unknown length of time and was eventually sold as scrap iron. As to the approximate date, I only know that when we went to look for it some years later it was missing, I don't know exactly when, somewhere about the neighborhood

of '23, '4 or '5. That was after the Hall installation.

By THE COURT:

Q. Now, let me ask one question. When you were testifying before the Examiner in Interferences, or by deposition, your testimony as I read it amounts to a pretty assured statement that the product contained lead suboxide, I can't make much else out of it, but that is the net result of your testimony. I am not trying to pick up a word here and there, but the whole thing contains to my mind a very definitely assured statement that that product contained lead suboxide, if I were listening to it, I would get that impression. Now, is your position now that you did not intend to convey that, or that you did intend to convey it but that you are satisfied it was a mistake and you have a different view now? I just wanted to get your interpretation of your testimony at the Interference. It is one of those two things?

A. Yes.

Q. I don't see how anybody can read that testimony, without getting the idea that you were testifying that there was lead suboxide in that product and that it could be controlled and that you could get as much or as little as you wanted.

A. My interpretation of that is this, that I specified that there was suboxide in there as defined in the terms which we had been talking about, and on page 370, to which Judge Morris referred, I think that is made quite clear, sir.

Q. Well, it isn't quite clear to me, I will be frank about it.

MR. MORRIS: May I ask one or two questions about that? I intended to, and forgot it.

THE COURT: Yes, in a minute.

By THE COURT:

Q. There either is or is not lead suboxide?

A. Well,—

Q. It either exists or it does not exist, and when you say it does not exist but it does exist as you define it, it doesn't carry much of an idea to my mind.

A. Well, I think I can clear that up to you, sir.

Q. I thought that your testimony as I read it was that suboxide did exist, and I couldn't—

A. The question as to—

Q. Now, you may have been—excuse me—you may have been mistaken at that time, or you may not have meant to say that, I don't know which it is, because you are saying something quite different now.

A. Well, may I explain?

Q. All right, now, you go ahead, I will stop.

A. The question as to the existence or otherwise of true chemical suboxide, Pb_2O, had long been a matter of doubt, nobody knew whether there really was such a thing or not. It was, however, listed in the textbooks of that time. We were all doubtful as to whether the real, true suboxide, Pb_2O existed, we didn't know. We did know, however, that we had, we could produce in these mills this black pyrophoric material which corresponded to the descriptions of suboxide. That was the sense in which I said I knew it existed. I knew we could make this black pyrophoric powder, and I still am perfectly convinced of that, we can make it today any time we want to.

Since that time new experiments, new work has been done on it, which has very much clarified the question as to whether the true chemical suboxide, Pb_2O, actually does exist. My opinion, therefore, is very strong as of today that the existence of the true lead suboxide has never been proved.

THE COURT: All right.

MR. MORRIS: May I ask just one or two questions?

THE COURT: Surely.

By MR. MORRIS:

Q. The Interference in that case, if I recall, involved patent 150 of Shimadzu. Shimadzu, as I understand it, described or catalogued, so to speak, certain characteristics—

A. Yes.

Q. —of the product in his patent. He assigned—am I right?

A. Yes.

Q. He assigned to that the name of suboxide?

A. Yes.

Q. Now, then, is your last statement, does your last statement mean that if Shimadzu's product, of which he defined the physical properties, was suboxide, that you had made that material, or not?

MR. WHITCOMB: Objected to as clearly leading.

THE COURT: Well, it is, but it is all right.

A. That is what I intended to signify.

By MR. MORRIS:

Q. Because that was the issue, as to whether that product—

A. That was the issue.

Q. —had been made, regardless of what it was called?

A. That was the issue.

MR. MORRIS: That is all.

Re-cross-examination.

By Mr. Whitcomb:

Q. Just a moment, Mr. Smith, it seems to me, now, you have referred to opinions, upon what authorities do you base your opinion now, and what did you during the Interference, what publications or authorities or books?

A. Well, there are plenty of books, chemistry books, up to a very recent time, which refer to suboxide of lead.

Q. Those that we have been hearing here in the testimony of Dr. Clark and others?

A. No, chemistry books in general.

Q. Do you include any of those he referred to?

A. I don't believe I did, because I think they were much later books.

Q. You didn't refer to Tanatar?

A. No, I referred to the common, ordinary, every-day chemistry books that you buy in this country.

Q. I mean, your answer now, you have expressed an opinion on information obtained in recent years?

A. Yes.

Q. Yes.

A. I said there had been a lot of work done, which had very much clarified the question.

By the Court:

Q. Well, but I still feel in line with all that, and assuming that you were talking in the terms of this patent, for instance, on line 38, where it says a coating of lead suboxide which being brittle and lacking tenacity compared with metallic lead, you still gave me the impression of talking about something different from ordinary lead oxide.

A. It was different from ordinary—

Q. Or lead monoxide.

A. It was different from lead monoxide, surely.

Q. Well, then, you get to a point where you have got to give it a name, and if it was different from lead monoxide, and it wasn't litharge, and wasn't red lead, and wasn't the other oxides, you must give it a name. Now, if we call it lead suboxide, all right, or if we call it lead half oxide, or anything else, but it still is a different chemical substance, and it seems to me you were talking about a different chemical substance from litharge and the various other well-known oxides of lead.

A. We didn't—we had no means of telling at that time exactly what was the chemical constitution of this material.

Q. Well, I say, but you talked about a—

A. I did.

Q. —different product, which you provisionally called lead suboxide?

A. Yes.

Q. Now, then, Dr. Clark comes along and he says, "There is a different product, and I call it lead suboxide":

A. Yes.

Q. So how do you and Dr. Clark really essentially differ?

A. We differ in opinions, I guess, only.

Q. Well, I don't see how you differ so much in opinions.

A. I agree—

Q. If you were talking, if this was a thing which was brittle, and lacking tenacity, and easily reduced to powder by aorasion, and was reactive, and all that, if that was something different from the known lead oxides, from the common lead oxides, then the question of what you call it is a matter of terminology, entirely?

A. Yes.

Q. And then Dr. Clark and you are very close together, it seems to me.

A. I think we are close together in that we both agree that suboxide, the existence of suboxide has never been definitely proved.

Q. Well, he thinks he proved it pretty definitely.

A. I misunderstood him if that is the case.

Q. Well, I misunderstood him if he didn't, if he didn't think he proved it.

MR. MORRIS: May I ask just one—

THE COURT: I am not passing an opinion on whether he did or not.

It might be I can make that a little clearer to your HONOR. This black oxide that we all got in those earlier stages was not any of the ordinary oxides, you couldn't go into the market and buy a ton of that stuff, buy it by the ton, it wasn't to be had, it wasn't the ordinary oxide. It was, however, as—it was probably a mixture of something, and its composition, its chemical composition, the amount of oxygen more or less corresponded to suboxide, and it was by the early chemists supposed to be a true suboxide. It was different from red lead, or litharge, or the ordinary oxides of lead, and there was no question about it being a black oxide of lead.

Lead monoxide is not readily reactive to oxygen at all. Lead monoxide itself does not burn in the air. Powdered lead, under certain conditions, will burn in the air. Exceedingly fine powdered lead, especially if it is a little flakey, can be made to burn in the air, will burn in the air. I think it will ignite spontaneously at times. The product that I was speaking of in Washington or in the Interference

was not pure monoxide. We didn't definitely know at that time how the product was divided chemically. But we did have the product responding to the characteristics specified in the Shimadzu patent, and he called that largely suboxide.

When I testified in the Interference, I understood that Hall was trying to get a patent on a process—I forgot whether he had a product claim in or whether he did not,—a process and product, if he had both claims.

JACOB HOELZLE was called as a witness on behalf of Defendant, and having been first duly sworn, testified as follows:

Direct-examination.

By MR. MORRIS:

I am employed by the Electric Storage Battery Company. I have been so employed for twenty-three years. I served the Electric Storage Battery in the capacity of sheet metal worker. I have been in that same capacity for the twenty-three years I have been there. I remember the installation of the so-called German mill in Philadelphia by the Electric Storage Battery in a building near the offices, at 19th and Allegheny Avenue. I saw the mill after it arrived. I did see the mill; I did some work in connection with that mill. I had something to do with the installation of a stack or pipe upon the top of that mill. The pipe was made of sheet metal, it was made fast to a hood over the top of the machine, and led through the roof. I know the size of that pipe. The diameter of that pipe was five inches. At

your request I made an examination of that roof a few weeks back, I have forgotten just when it was, September perhaps of this year. I found the hole still in the roof, through which I inserted that pipe. It is covered with sheet iron and also covered with rubberoid roofing. I did measure it at the time I was on the roof just a few weeks back, and that told me that the pipe that I had installed was a pipe of five inches diameter. I can fix the time of this as within one, two or three years after my daughter's birth, and she is twenty-one now.

Cross-examination.

By Mr. Whitcomb:

I haven't any definite records, written records of any kind.

Benjamin Shablin, was called as a witness on behalf of Defendant, and having been first duly sworn, testified as follows:

Direct-examination.

By Mr. Morris:

My occupation is Laboratory man, and I work for the Electric Storage Battery Company. I have been employed by the Electric Storage Battery Company since July 3, 1916. When I began work with the Electric Storage Battery Company, I was casting lead balls, at 19th and Allegheny Avenue in Philadelphia for a Tudor lead machine. The Tudor lead machine was making lead dust. About six weeks from the time of my employment it began to make lead dust. The mill had a drum

in it. The drum was rotating. The mill was operated under the direction of Mr. Kershaw. We made a supply of lead balls and put them in the drum, and the drum was rotated and we were getting gray oxide from the chute. The chute is marked. (The witness indicated the part on the drawing, Plaintiff's Exhibit 43.) That is the supply chamber. That which seems like a hopper at the left-hand end of this drawing; that would be the way the balls were fed into the machine. That was the supply chamber. Gray oxide came out of the drum, right through the screen, through that chute, there was a screen surrounding the drum in which the balls were; the gray oxide came through the screen and down through a chute into a drum. In the beginning we sometimes had a wooden skid for the drum, in which the final powder was. But that material used to get red hot, charred the bottom of the skid, so we had to move that and put an iron truck under that. In the beginning we placed the drum in which the powder eventually went upon a wooden skid, and we found that the drums would get so hot that it charred the wooden skid. So much so that we stopped using the wooden skid and took a metal truck.

I know that a stack or pipe was put on the top of the jacket around the mill. I can fix the time within which it was so placed as about the middle of September, 1916.

Q. You can or cannot give me an exact date?

A. Why, we make three runs, from the day we made a supply of ten thousand balls, we made the first experimental run,—

Q. Yes.

A. —then we made about three or four runs, that would require to do it, we used to shut the mill every

week, so I would say for the time about the middle of September, possibly a few days later.

Q. Middle of September is your estimate and the best estimate you can make, is that it?

A. 1916.

The reason that I estimate that it was 1916 is that 1916 was the date of my employment. I have no other record except the log sheets showing when these runs were made, in fixing the date of September. But that is the way I fix the middle of September or thereabouts. There was some ventilation opening at the bottom of the chute, near the delivery tank. It was a hole about three inches in diameter, we had a lid over that and used to operate it by increasing or decreasing the size of the hole. I remember what difference it made in the operation of that particular plate or baffle over this lower opening when we installed the stack. The material wasn't hot any more, it was coming down more uniform and finer in particles, and it wasn't getting hot inside the drum. It didn't get so hot inside of the delivery drum. We only had it closed the width of a match stick, the thickness, somewhere around an eighth of an inch. Sometimes it was closed so that the opening was only about the thickness of a match stick. The width of the opening was only about equal to the thickness of a match stick. I will describe the mill so far as I haven't already covered it. The mechanical construction of the mill I really don't know, because I didn't put it up in any way. We took it apart once or twice to clean the screen but the operation of that is the only thing I can describe, the delivery of the gray oxide, the lead dust, and practically everything Mr. Morris here described was the thing I had to tell. I have memory what it is. In addition to what I have already said, we used to make that to fill up two or three drums and deliver that to the pasting depart-

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ment, had a few stops during that period, and then about that chimney, up.

Cross-examination.

By Mr. Whitcomb:

At that time, up until September, I had seen the drum inside the mill, we cleaned the screens. I didn't get in there, but cleaned the screens. The diameter of the stack that went up the top I should say was four or five inches. It was a little smaller than the inclined outlet pipe. The pipe went right from the center. It was about four or five inches. The pipe coming through the roof was, I would say, about four or five inches. (The witness indicated the pipe by drawing lines on Plaintiffs' Exhibit 43.) To the best of my recollection those two lines are all right to represent the stack. There was no fan to blow this air in. We had to decrease the air, not increase it when we put the stack on, so that, I presume, not as much air went in as before.

I was in the Army at the time that mill was scrapped, I believe, I am not sure though. I went in the Army in 1918. When I came back I wasn't employed any more in that particular department. I have a record as to when I went in the employment of the Exide Company. It was the third of July, 1916. That was my first holiday in the United States, my first holiday here.

Re-direct-examination.

By Mr. Morris:

I ran this mill at every noon hour.

GEORGE M. HOWARD was called as a witness on behalf of Defendant, and having been first duly sworn, testified as follows:

Direct-examination.

By MR. MORRIS:

I am employed by the Electric Storage Battery Company. I have been so employed since September, 1895. I am in the Department of Development and Design, one of the divisions of that department. I don't know exactly how long I have been in that department, about thirty years, I guess. I was in that department in the 'teens. In that department I had something to do with the processes for pasting plates. (Paper entitled "Factory Process for Mixing Lead Dust Exide Positive Paste" was shown to the witness.) It is a factory process for mixing lead dust Exide positive paste, dated November 28, 1916. I do know what the words "lead dust" in that paper mean. They mean the product of the lead dust mill that was being operated under Mr. Kershaw.

(Counsel for Defendant thereupon offered in evidence as Defendant's Exhibit No. 76 the paper entitled "Factory Process for Mixing Lead Dust Exide Positive Paste", dated November 28, 1916, which was received in evidence and marked Defendant's Exhibit No. 76.)

I made a calculation to show the number of C. C.'s of water to three hundred grams of lead, carried out according to this formula. The calculation showed in C. C.'s 47.3. This was sent to the superintendent's department by me with a note asking them to make paste according to this process. I had authority to do that.

(No Cross-examination.)

WILLIAM ERNEST KERSHAW was called as a witness on behalf of Defendant, and having been first duly sworn, testified as follows:

Direct-examination.

By MR. MORRIS:

I am connected with the Defendant in this case, I have been since the fall of 1906. I am in the Department of Development and Design, with the title of engineer in charge of research. I have been in that position since about January, 1915.

(A book was shown to the witness.) This is a note book which I used in connection with the operation of the lead dust mill installed in 1916 at 19th Street and Allegheny Avenue. It contains the first notes of the operation of the mill and the directions given me by Mr. Smith as to how the Germans operated the mill, et cetera. The mill referred to is the mill made, I believe, from German drawings. Anyhow, it was reported to me to be a copy of the German lead dust mills as operated by them for some years. The lead dust in question was the product of that mill. The mill consisted briefly of a rotating drum, supported by trunnions, carrying on or in its periphery a large number of small holes about one-eighth of an inch in diameter. The trunnions on which it was supported were hollow, so as to permit the introduction of material into the drum. One trunnion was hollow, and I am not certain about the other. I will have to apologize. The drum was approximately five feet in diameter, by three feet wide, that is in length. The drum was supplied with flanges attached to its periphery at either side, or either end, if you are referring to the horizontal dimension, which carried a screen, the screen, of

course, rotating with the drum. There was a casing around the drum, which at the bottom became funnel-shaped, and ended in a delivery pipe running down to whatever receptacle was placed for the receiving of the product. Turning to the operation, balls approximately five-eighth inch in diameter of lead were fed in through a trunnion until the load of approximately two thousand pounds had been supplied, and the mill was then put in operation, and as the balls became turned into the oxide product the load was maintained by feeding in from time to time more balls to keep the load somewhere near some figure, around eighteen hundred to two thousand pounds. The moving parts of the mill were the rotating drum referred to... We usually started the operation at the highest speed we could obtain with the drive, which was about fifteen revolutions per minute, and then as the temperature—

THE COURT: By the way, what was the speed of the plant that I saw operating this morning?

MR. STOUGHTON: Fourteen.

THE COURT: Fourteen.

(Continued) As the temperature rose the speed was reduced. The operating speeds were usually between eleven and thirteen revolutions. The lead balls are chunks that were fed into the mill, and were approximately five-eighth inch in diameter. After they got into the mill they actually became abraded, due to the operation of the mill, and became smaller and smaller in diameter, so that at any time after, any considerable time after the first starting of the mill there would be balls of all sizes, from five-eighths of an inch down to the size of a small pea. In Plaintiffs' Exhibit 43

there seems to be classification of the balls in size. That is all right. From viewing the contents of the mill when it was not rotating, after stopping at the end of a run, I can't say that I received any impression that the large balls were always on top and the small ones underneath, as shown there. There may have been a tendency in that direction, but I didn't get that impression. Turning back to the operation, on starting the mill with a fresh charge, the mill being, of course, cool, and the balls all of one diameter, the product for some hours would be a very black, velvety powder, with a very marked tendency to ignite on coming in contact with the outer air. That, I believe, was so much the case that to my present recollection we never started up with new balls in the mill without having the material catch fire, either in the delivery pipe or after it reached the receiving drum.

The mill was put into my direct charge by Mr. Ford, who was then in charge of the Department of Development and Design. I did receive information with regard to its operation at the time I was put in charge. Turning to my note book, I find under date of June 5, 1916 notes which I made from information given me by Mr. Smith on that date, and from his notebook which he showed me, as to how the German Company operated their mills. I made that note book entry on June 5, 1916.

(Counsel for Defendant thereupon offered in evidence as Defendant's Exhibit 77 pages from the note book of the witness Kershaw, which were received in evidence and marked Defendant's Exhibit No. 77.)

Mr. Betts: We object to that, your Honor,

what the witness wrote down, what someone else told him about what was done in Germany.

THE COURT: Well, I will note the objection, of course, and take it subject to the objection.

In this exhibit, this note book which I am about to read from, is a description of the process given me by Mr. Smith. It was my information at the time that it represents something that he saw in Germany. It does not contain an order to me to do anything.

THE COURT: All right, well, I will take it subject to the objection.

The witness resuming, testified:

It is headed "Lead Dust", mill 800 to a 1000 kilos, contains 1765 to 2204 lbs? start, 800 kilo., start at 15 revolutions per minute. Temperature of air inside cases 65 to 70 degrees centigrade. Hold 68 to 70 degrees centigrade. Above those are Fahrenheit figures, that is, 65 to 70 centigrade corresponds as I have it noted here to 149 to 158, F. And the 68 to 70 centigrade corresponds to 154 to 158 Fahrenheit, as I read it. It is very faint. Speed, 13 to 15 revolutions. Control temperature and also weight of material inside. Run for about two days, throwing away product, but weigh what comes out and add lead on basis of two to four per cent gain in weight. In starting use entire new charge, emptying out old through hand hole. Final product analysis 95 to 96 per cent lead. Output, 15 to 20 kilograms per hour. Above those are figures which translate them into pounds, but I can't read them in this light. A kilogram equal about two and a third pounds, so that is about twenty-five to forty pounds, I think, but I can't read it. Mill cold equals coarse powder. More balls equals finer powder. More speed

equals coarser powder. Must be used within three days after being made, even though almost hermetically sealed. Specific gravity is kept between 2.1 and 2.2 (Scott volumeter). Below that is the standing order under which this operation was carried on, that is, the Electric Storage Battery Company's standing order 432 V, the building number, building number 24, and two plant order numbers under which work could be done on the mill, the first, 16732, and the second, 17953. Under that I find a note, bulb for recording thermometer takes one-half inch pipe thread. Another note, second floor, Meyer; proper name, M-e-y-e-r. At the bottom of the page, under the heading "Pasting", one kilo to 165 grains of four degree Baume acid equals 1454 C. C.'s of 1.0284 acid to 20 pounds, equals 72.7 C. C.'s per hour. Ninety-five per cent of lead in the material figured as PbO would be approximately Seventy per cent PbO, and ninety-six per cent Pb, calculated as PbO, would give you fifty-six per cent PbO. Turning to the entry at the bottom of the second page, I have or have had translated into C. C.'s of water 300 grams of lead. It comes to 47.3 C. C.'s for 300 grams of material.

Turning to Defendant's Exhibit 16, under date of August 3, 1916 there is a record of the mill operation. It gives the time of starting, 2.35; the temperature as 85; weight of drum, 65 pounds; 15 revolutions; finished 4.40, temperature 121; 15 revolutions, gross weight, 156 pounds. Defendant's Exhibit 17 in the same note book under date of August 17, 1916, is 15 Hycap positives, stamped LD 1 A, air dried; 15 Hycap positives stamped LD 1 B, pickled; 60 pounds of lead dust, small mixing machine. Then follows a calculation of the

amount of acid required for sixty pounds of lead dust, which comes to 4,362 C. C.'s of 1928 acid, mixed ten minutes, made into smooth paste, easily pasted, pasted on cloth like negatives. Weight of 10 wet plates, 19.4 pounds. Weight of 10 grids, 7.1. Turning to the first line under the date in that, I read "15 Hyc.", 15 Hycap, and the plus mark following Hyc. stands for positive. The LD stands for lead dust. Lead dust means the product of this mill which we operated at 19th Street, and which I believe to be a copy of the German mill. I have not made a calculation of the C. C. of water to 300 grams of product shown by that entry. I have no doubt that it is substantially the same as the calculation at the bottom of my first page. I will accept that, subject to correction.

The mill was set up when I was first given charge of it. There was no stack or vent on top, when I was given charge of it. It had an outside casing. I told you that it had a screen between that casing and the rotating drum. As shown on the Plaintiffs' diagrammatic section, the outlet is not correct. I believe a correction has already been made, which is approximately correct. The outlet to the drum as originally shown in this sketch, Plaintiffs' Exhibit 43, is not correct. There was a hood, as shown in correction B, that was attached to that outlet. I am referring to the receptacle into which the material is ultimately discharged as the drum, in that instance. The function of the hood was to prevent too free an access of air to both the receptacle and the material in the mill above. I agree with Mr. Ishimura, Dr. Clark and Mr. Smith, that there will be no product at all by rotating lead balls in an inert atmosphere. I am in thorough agreement with

them. I did get a product from this mill. I can describe the product. As I previously testified, the product at the start of a run would be almost jet black in color. That color would vary as the run proceeded and the temperature of the mill came up to a rather dark olive green, at which we habitually stabilized conditions so as to continue to obtain that product. Of course, on experimental runs we went to higher temperatures and higher oxidations, in which case the product tended to become a somewhat yellowish green in color. As to its reactivity, the black powder ignited most easily, the green and yellow powder could be ignited, that is, the yellowish-green powder produced by this mill could be ignited. The material oxidized very readily when it became wet, and in bulk on wetting it sometimes produced enough heat to start an actual incandescence in the mass of material. I had the oxygen content of these calculated, and I calculated it, both. The lowest analysis calculated as PbO that I recall was about 44%. I do not know offhand what that would be if it were calculated as Pb_2O. We ran in oxides calculated as PbO as high as a little over eighty per cent. I observed that the higher the oxidation the lower the reactivity, and the lower the oxidation the higher the reactivity. I operated this mill on July 25, 1916, when we began some experimental runs, until the middle of 1917. I personally operated the mill until the end of the week ending June 17, 1917. There was a further run in August, but I wasn't present. There was a run recorded, on the mill sheets, mill log records. I think that they will be in evidence. Mr. Shablin, who testified, a Mr. Kahn, who was my assistant at the time, and Mr. Shemberger and Mr. Gallag-

her assisted me in the operation of this mill. Mr. Shablin is the only one who is still with the Company. Our treasurer's department record shows that Mr. Gallagher left on April 12, 1918. They show that he was employed August 7, 1916. With respect to Mr. Kahn, they show that he was employed in February, 1916, and left on August 24, 1918. Mr. Kahn was my assistant in the operation of the mill and had charge of the men when I couldn't be present. Mr. Shablin was principally employed in casting balls, but took charge of the mill during noon hours; Shemberger and Gallagher had twelve-hour shifts, in actual operation, with the exception of the noon hour, when Bennie Shablin took charge.

Within limits we were able, as a result of our experience, to stabilize the mill very nicely to whatever product we desired. I did make a report to the Company with respect to the results of my work. That report was made July 24, 1917. (A report was shown to the witness.) This is the original typewritten copy of that report. It was made to Mr. Ford who was in charge of the Development and Design Department of the Defendant Company at that time.

(Report of the witness Kershaw dated July 24, 1917 to Mr. Ford was thereupon offered and received in evidence and marked Defendant's Exhibit No. 78.)

Mr. Whitcomb: If your Honor please, we have an objection that we want to apply to all this testimony about a certain part of this report, attempting to establish a public use. There is no publication of this. The patent statutes require printed publication, on the one hand, or a certain

use on the other hand. Now, a mere memorandum of something which did not materialize into a structure is inadmissible for any purpose, so there are certain things that may come out, I mean, we don't like to—

THE COURT: Yes, that is all right, I will understand that that objection applies to all the testimony offered along those lines.

MR. WHITCOMB: Yes.

The witness resuming, testified:

As given in this report, the specific gravity figure was from an estimate by what we call a bumpometer, in other words, it represents a packed weight. The Scott volumeter is an unpacked weight in a cubic inch. In comparison, the Scott volumeter reading is naturally lighter than the bumpometer reading: by roughly one-half. That is, the bumpometer test is about twice what the Scott volumeter reading is, so that the apparent specific gravity when the material is not packed in the receptacle in which it is measured would be 1.5 to 2., under item "C". That is apparent specific gravity. This is the tube which is referred to as "K" (indicating on Plaintiffs' Exhibit 43.) It is the tube just opposite the letter "B". It is the diagonal tube. (Mr. Whitcomb marked Plaintiffs' Exhibit 43 with the letter "K". These letters in my analysis, these letters to the right of the page and the various items that are lettered there, go to produce certain characteristics of the product. They are either parts or methods of control that produce the various characteristics that I have listed as "A", "B", and "C". The tube which I have referred to which is just above the receptacle, into which the prod-

uct is ultimately delivered, played a part in the extent of oxidation of the product, because it was there that the fresh air entered. The air being highest in oxygen content at that portion tended to oxidize the material further than the partially exhausted air which would be found up in the main mill. The air passed up the tube, which has been marked "K" on Plaintiffs' Exhibit 43. If it had not entered somewhere there would have been no product. If the top of the mill had been hermetically sealed, it could have been hermetically sealed and no air admitted through the tube "K", there would have been no product.

With respect to the casing surrounding the mill, after the mill had been in operation a few weeks it was found advisable to put a pipe or stack or chimney on the top of that casing up through the roof of the building, so as to accomplish two ends. One was to gain a better control of the air flow through the mill, and the other was to change the air pressure on the inside of the casing near the top from a positive pressure to a negative pressure, so that instead of air leaking out into the room and carrying dust with it, the top of the mill was under slight suction, with proper regulation of the draft, and any leak would simply admit a little air to the casing instead of allowing the lead dust to leak out into the room. I know positively I did it. It was done in the fall of 1916, I can't fix the exact date.

I have heard the testimony about the sale of batteries to the New York Railways made of dust of this machine, the product of this machine. I can swear that the stack was in place before we made any material for outside use.

There was a damper in the stack for the better control of the air. Turning back to page two

of my report, the screen referred to in the middle of paragraph entitled "J", is on the periphery of the drum, and I have no reason to change what I said here about its function, that its function is not to sieve the material but to assist in the proper oxidation. We made runs and produced usable material without any screen on the drum. The initial runs bear a very direct relation to those figures given me by Mr. Smith, as recorded in my note book, "Defendant's Exhibit 77." They are not exactly the same, of course, but they show that during that period I was operating quite close to the German instructions. Page 3 of my report, second paragraph, is the paragraph reading "Control the character of the product as far as possible by the external and internal ventilation systems, installing fans if necessary". We did not actually install any fans at that time. I did have it in mind for controlling the ventilation, as an improvement. As to what we did to control the product, we could, of course, change the load either up or down by either failing to put more balls in the mill or adding more balls. We could change the ventilation. As it first operated we had not any control over the air, but after putting in the stack we had a very excellent control over the air in the damper in the stack. There was also a control through small lids which could be so adjusted as to cover partially or completely the holes in this outlet leg. I mean the receptacle hood. The holes were for the admission of air, the holes in the hood as shown there were for the admission of air to the mill. I mean this little point which you are marking "M". That would be a depiction of one of the holes, the other marked "N". I had control of the openings that are marked "M" and

"N" respectively, on Plaintiffs' Exhibit 43. I had small adjustable lids which could be slid to one side so as to open those holes or slid to the other side to close them practically completely.

By THE COURT:

Q. You don't say anything about that in your analysis. It would be under "B", oxidation, wouldn't it—temperature of and ventilation, well, perhaps that is under temperature of and ventilation through the machine?

A. Under "H"—

Q. "H", yes.

A. —if your Honor please.

(Counsel for Defendant here offered in evidence as Defendant's Exhibit 79 four pages numbered A, B, C and D of the witness' original note book, which were received in evidence and marked "Defendant's Exhibit 79".)

The date of the first sheet of Exhibit 79 is August 7, 1916. On page 2, I find screen tests made on German lead dust. I mean that the material was put through a nest of screens. This lead dust is material received from Germany, samples received from Germany. It contrasts with the E. S. B. lead dust on the following page. In the first, under examination of the lead dust which was imported from Germany, we got certain tests on one cubic inch of weight. That weighs 32.277 grams. Sixty mesh screen means sixty meshes each way, so to get the number of holes you multiply sixty by sixty. And one hundred and ninety mesh screens means one hundred and ninety holes each way. And the holes per square inch would be one hundred and ninety by one hundred and ninety. I think the number of holes in a two hundred and sixty

mesh screen was about fifty-seven thousand. That is translated into percentages in the right-hand column, that is (indicated by counsel) what was on the bottom of the pan. The calculation of fifty-seven thousand six hundred is correct. The screen test was with a set of nested screens, and by that I mean that they were placed one above the other and held together by the bottom one nesting into the top of the next, the lowest in the nest being a solid bottom and called the pan here. The percentage of the cubic inch of material with which we started which was found on the bottom pan as having passed all those meshes in the No. 2 sample, was 55.7, and the No. 3 sample 76.6 per cent. On the number 2 the specific gravity was 2.046 on the Scott volumeter. On the number 3 sample, the specific gravity was 1.804 by the Scott volumeter. Turning over to the next to the last page of Exhibit 79, the material with which I started out there was lead dust of our own manufacture; that is, made in the Nineteenth Street lead dust mill under my supervision. The manner of the test was exactly the same. The percentage found in the pan in the No. 1 E. S. B. lead dust test was 72.5. That was No. 1. And the specific gravity of that was 1.813. That was before screening. That was the specific gravity of the material with which we started obtained by a Scott volumeter. The third column is the amount that remained on the sixty mesh screen. We started out with an actual weight of 29.7 grams. That is the weight and not the percentage.

You got 72 per cent to the pan, so your dust was finer than the German dust, wasn't it?

A. Well, I—

Mr. Morris: Finer than the German No. 2?

The Court: Yes.

MR. MORRIS: Not quite so fine in that one as in the German No. 3.

The E. S. B. lead dust No. 2 is the same process. I will have to correct the former statement. The multiplication of the two hundred and sixty mesh is sixty-seven thousand six hundred. The number of holes in the two hundred and sixty mesh screen is sixty-seven thousand six hundred per square inch. Passing back again to the test of E. S. B. lead dust No. 2. I calculated last night the percentage of the cubic inch which passed into the pan through these three screens. That was 76.5 per cent. So that that corresponded within one-tenth of one per cent of that in the German No. 3. The specific gravity of the No. 1 E. S. B. lead dust was 1.813 by the Scott volumeter. Turning over to the last page, we obtained the specific gravity from those weights by dividing the Scott volumeter in grams by the weight in grams of one cubic inch of water, namely, 16.38, you can obtain the apparent specific gravity. So that, to translate the weight of the cubic inch, you have the weight shown on this page. The weights shown on this page (indicating are the weights of one cubic inch. Dividing that by 16.38 gives you the specific gravity of 1.91. The same would apply to the sample at four P. M. of eight sixteen. These are all consecutive pages in the note book. The first entry is August 7, 1916, and on the last page the entries show that Scott volumeter readings were made on material made on August 16th, 17th and 18th of 1916. The specific gravity of the sample at four P. M. on the last page of Exhibit 79 would be approximately the same as the preceding one. It would be just a trifle more because you have the figure to be divided by 31.87 at the top of the page and your divisor is the constant factor of 16.38.

Shortly after we started operating, we began making weekly log sheets of the runs and they were regu-

larly kept until the mill was shut down. The first one is August 13th to 19th, 1916. That shows the temperature as recorded inside the casing at the top of the mill. At Nineteenth Street in Philadelphia of which I have ben speaking, mainly. I have a marginal note on the left-hand side of these sheets. The temperature of the mill on the date when we began recording was 141 Fahrenheit. The marginal note says times ten, equivalent weight of balls per hour, weight of dust per hour, temperature, and per cent of PbO. In other words it means that the 14 is to be multiplied by ten. In other words, read as 140. That is 140 Fahrenheit. Translated into Centigrade, it is exactly sixty. Sixty times eighteen, that is one hundred and eight, add thirty-two that makes exactly one hundred and forty Fahrenheit or sixty Centigrade. It was 141.

THE COURT: Now, don't you think I can see all that Judge, without reading all that into the record? I mean, it's so easy to see from that graph.

MR. MORRIS: Yes. Well, I think that is about all we need, except the load in the drum, which I think is calculated on the right-hand side. The entries are there.

THE COURT: Yes. There's the weight of dust per hour, the equivalent weight of balls per hour that's in the drum.

THE WITNESS: No. This is the weight of the product per hour produced and the weight of the balls fed into the mill,—

THE COURT: Oh, yes.

THE WITNESS: So as to maintain the load at the same figure.

THE COURT: Yes.

THE WITNESS: That would show, in this case, that we started at about fifty pounds and averaged a little over forty pounds in our production while the mill was run.

THE COURT: You went down pretty low here (indicating) to twenty pounds.

THE WITNESS: That's the ball feed.

MR. MORRIS: That's what?

THE WITNESS: The ball feed.

THE COURT: That is ball feed, that's right, I got them mixed up. That is the ball feed, and the dust is pretty regular.

MR. MORRIS: I think there is nothing else that needs explanation there?

THE COURT: No.

On the second sheet already in evidence as 18-E, the notations at the bottom show that we started at a temperature of 105 approximately. It took from six A. M. Monday to approximately six P. M. Monday to get up to where we were going and then the curve speaks for itself thereafter.

L. D. No. 3 stands for lead dust No. 3. It is the third lot of experimental plates pasted on the date shown below, August 22, 1916. And the same thing as to L. D. No. 4. The graph in the lower right-hand corner shows that there was a record lost in there. That is the weight of the dust, and he equivalent weight of balls, and we got the same thing in all of these. The L. D. entries on all of these are for showing the samples pasted on the experimental plates. The pasting date is given below each one. Referring to the one for

twelve, thirty-one sixteen to January 6, 1917, the note there "No screens used during this week" refers to the screen on the periphery of the mill. In other words, that screen was taken off and a product was made without it. That is the revolving screen on the periphery of the mill. Referring to the one of February 4 to February 10, 1917, the bottom note reads: "Damper in flue closed at two P. M. Outside openings around delivery pipe were tightly closed". There is something on some of these later sheets. The oxidation curve which shows up on those sheets, I don't know whether that is in.

Q. Some of the subsequent sheets have a PbO percentage. I have one before me, one, twenty-one, to one, twenty-seven, 1917. Those sheets merely show, do they not, the percentage of oxidation calculated as PbO?

A. That's correct.

Q. Was there one in here in which the specific gravity was calculated by the bumpometer test, do you know?

A. The specific gravity, when given on these sheets, is given in terms of the bumpometer reading, so that, to get it into the apparent specific gravity of a Scott volumeter or as shown in the patents, you divide it by two. Of course, neither one gives an absolute figure. But that would give the approximate test as indicated in the patent in suit.

Mr. Morris: Direct-examination closed. Oh, yes. These graphs I offer, as a whole, as Defendant's Exhibit No. 80, and they consist of thirty-one sheets. They consist of thirty-one sheets, and it is Exhibit No. 80. That consists of thirty-one graphs of log sheets of the German mill, so-called, operated by E. S. B. at Nineteenth and Allegheny Avenue in the years 1916, 1917 to and including five, twenty—five, eighteen, 1918.

(Thirty-one graphs of log sheets were marked as Defendant's Exhibit No. 80.)

Mr. Whitcomb: Are you going to introduce this note book?

Mr. Morris: As an exhibit, it went in, a copy of it, but you can use the original if you want. We would like to have the originals but they are subject to the Plaintiffs' inspection at any time, if that is suitable to your Honor?

The Court: Yes.

Cross-examination.

By Mr. Whitcomb:

These curves on Exhibit 80 were prepared week by week as the individual mill sheet reports were sent up to my office. This mill produced on the average of between forty and fifty pounds of lead dust a hour in the regular production. According to Dr. Wilson's report in this case, that our present mills produce about eleven hundred or twelve hundred pounds in order to produce the same amount as produced by our mills now, you would have to have about thirty of these. That sounds correct. The way we ran the original mill we showed, on experimental, a production up to eighty pounds; but you asked me the average. Here is one that shows seventy-five. It is the record of February 4th to February 10th, 1917. I think—I beg your pardon, I am wrong on that. Just wait a minute. One, twenty-one to one, twenty-seven—shows it sixty-five. Four, twenty-two, to four, twenty-eight, 1917 gets up to eighty. That's the sheet I was hunting for. It goes to eighty or eighty-one pounds. The dust contained various quantities of small lead pellets. That would make it less weight per hour. The same volume,

if it was fine, would be more than if it was coarse. But we are simply taking what was produced. I cannot say whether it would make the weight heavier or lighter. If we had produced the same volume of material and it had all been fine, it would have weighed less because the gravity of the lead pellets, the apparent density. Of course, it would depend on how tightly the dust was packed. The highest production we showed per hour was eighty pounds. Even at eighty pounds per hour, as compared with our present machines, that would require about fifteen of these mills to product the same amount we produce per hour now. Some of these runs were for production, and some of them were for experimental; frankly, experimental. This particular one was one of the experimental runs—that was not made for production—I made to establish how high a production we could get. It was not put into production plates. It wasn't a very good product; we didn't like those lead pellets.

I understand that this very mill was finally scrapped. I don't know that it was of my own direct knowledge; only by what I have been told. I am willing to agree that it was, yes.

The size of the holes in the main drum was approximately an eighth of an inch, if you are discussing the small holes in the periphery of the main drum. It seems that any particle an eighth of an inch could go through it. We had particles an eighth of an inch only when we ran without a screen. The biggest size we had with the screen was whatever the screen would let through, namely, if you had a sixty mesh screen, there was a particle corresponding to that in size. The grading effect of the screen was of a very minor nature. As to the difference of what would pass, an eighth of an inch and sixty mesh, there is a distinction whether I am trying to make it or not due to the rotation of the mill. Due to the rotation of the mill, a

particle which would normally easily pass an eighth of an inch hole would not normally fall through the hole. The sliding action and the speed of the outside of the mill tends to prevent those particles from going through. But without the screen, there were occasional particles of the diameter of an eighth of an inch forced through some of the holes, but they were very minor in quantity. An examination of those particles doesn't show them to be composed of solid lead. They are composed of a mixture of lead and lead oxide, and they finally, apparently, abrade. Anyhow they become of such size they will go through the screen. We were about to use the product from the mill without the screen. I would not be able to use a product containing pellets as large as an eighth of an inch in size without a secondary process of screening. Some particles an eighth of an inch in size would occasionally go through without a screen. Those we cannot use. We would not regularly use that product without some means of sorting. I would say that the proportion, drawn in pencil on this Plaintiffs' Exhibit 43, as compared with the lower delivery pipe K is in reasonable agreement.

Q. All right. I notice in several of these charts, particularly in the earlier exhibits introduced by the other witnesses, as time went along you tried to increase the loads and then dropped back. For example, if you will review Exhibits 18-A to E—will you hand me those Defendant's Exhibit 18-E, the whole bunch of 18?

Mr. Morris: Yes. They are called 18, but they should be 18-A.

Mr. Whitcomb: Yes.

The Court: It almost looks the other way to me. It looks as if they got to a certain point where they had to check the feet and drop it off.

MR. WHITCOMB: You have all the other sheets, too. I will ask you to go ahead.

THE COURT: Yes. Well, I was using both of them. It looks as if you went along fairly steady for a while and then you would have to drop it.

MR. WHITCOMB: That's what I am trying to have explained.

This record of no operation for the week of August 20th to 26, 1916, the first sheet of this series, indicates to me that we were trying an experiment there of letting the load in the drum get quite low, in order to discover just what effect that had on the type of product and the rate of production. In the next experiment in that series, Exhibit 18-B, we went up to nineteen hundred. Eighteen hundred pounds to two thousand pounds was the range of load that we normally carried for production purposes. You will find figures outside of that but they are mainly experimental or some effort to control the mill. We were not making efforts to increase the yield, increase the load and get more product out of it. My first record, I think, will show a load in the drum of around seventeen fifty; but, anyhow, we let it go down. We made an effort to increase the yield during this year on that mill. I said a minute ago that was not our main purpose at the time. We made experiments to try to increase the yield. Eighty was the maximum. I believe we could have maintained eighty with that mill. We didn't get a good product at eighty. Our top figure was about sixty for the usable product. For our present mill, twelve hundred pounds an hour, we would need twenty of the old mills to give the same yield.

By THE COURT:

Q. What I don't quite see—I don't know that it

makes a bit of difference—is why the lead in the drum will go up when the weight of the feed and the weight of the dust is just about constant. Just, as an example, take ten, one, to ten, seven, 1917—the lead in the drum apparently increases steadily, and you have got an almost constant, almost level, line there. What makes the lead of the drum go up? If you keep feeding the same amount of balls in and taking the same amount of dust out regularly, right along, why does the lead in the drum increase? That's ten, one, to ten, seven, 1916.

The equivalent weight of balls per hour as shown in ten, one, to ten, seven, 1916, is at a higher figure than the weight of dust produced per hour except at two small intervals. If those two lines were on a level, the lead in the drum could not possibly go up. The first figure I can give you as to the minimum yield of usable material is forty. At forty pounds an hour we would require thirty mills of the old type to equal one of the present.

The thermometer in the tests for temperature change for all these previous runs was placed in the top of the casing not very far from the stack. I did not know what temperature was inside the main rotating drum. The system or method we had for ascertaining the chemical analysis was this. Samples were taken, after we once got under way, at regular intervals and sent to the chemical laboratory, in most cases, although some of the earlier ones I analyzed myself. My method of analyzing was to treat some of the lead dust with dilute acetic acid and wash the precipitate lead filter—precipitate for lead in the filter, that is, the lead that had dissolved—weigh the lead and then calculate back to lead.

The figures on all these charts are not all of them mine, but some of them are. The majority are by our

chemical laboratory. In connection with the air, we never measured the amount of air passing through the drum. As I remember the witness Shablin's testimony. I recall only one o r two occasions on which we closed the lids over the lower area that is marked M on the Plaintiffs' diagram to only the width of a matchstick. Most of the time they were certainly opened a matter of ten per cent of the area of the hole. We had them closed that close at times, but that was not our normal opening though. I do disagree with him to that extent. The product manufactured in these experimental runs that we had of this mill, in my opinion, is quite similar to the material made by Hall when he began making the material from the Hardinge mill. It is not substantially different. I would say that Mr. Smith was acquainted with the character of the material at both those times. I would suppose that he was acquainted with those facts in 1927 and 1928. He must have known them in 1921 or '22, if they made it in '22, as comparing it with the material they had made at earlier times.

I didn't explain why that one sheet didn't have a record for a day there. That record was lost. There is a notation on the bottom of the sheet to that effect, I think, but I may be thinkin' of another record. The second sheet has a note at the bottom "Record lost—", I can't quite read the time here, it is a little faint; if we had the original, that would appear. The mill was not shut down, evidently.

I don't know of any company in this country using one of these types of mills today, exactly as shown. The Willard Company is, I think, and there is one in Toronto. In the United States, I don't. I think there is. I have no knowledge of that. We have heard of the Willard installation in the far West—in California, I believe. I don't know that of my own personal

knowledge. At that time or during the time surrounding the operation and production of oxides from this mill, the company was purchasing a considerable quantity of oxides on the market. I cannot say as to how that amount would compare with the amount made by the mill. I feel reasonably certain that we must have been purchasing much more than this mill made.

Re-direct-examination.

By Mr. Morris:

Q. Mr. Kershaw, other things being equal, could you make more of a product in the circular, hollow cylinder made of iron sixty inches in diameter and sixty inches in length than you could in one thirty inches in diameter and sixty in length?

A. The product would be in proportion to the length.

Edward W. Smith, a witness on behalf of defendant, was recalled.

Re-direct-examination.

By Mr. Morris:

(Counsel for defendant offered in evidence a letter headed "Lead Dust, etc.", October 3, 1919, addressed to Mr. R. C. Norberg, signed Edw. W. Smith; and two pages dated 10-3-19, headed "Notes on Manufacture of Lead Dust", signed E. W. S., Factory Engineer, which were received in evidence and marked Defendant's Exhibit 81.)

The first of these is a letter headed "Lead Dust, etc.", dated October 3, 1919; it isn't quite clear there— addressed to Mr. R. C. Norberg, who was at that time

our factory manager or something of that sort, of the Willard Company. It is signed with my name, Edward W. Smith, d B., and that is my signature, signed by William duBois, who was at that time secretary to the president and authorized to sign my name. The second and third sheets are notes on the manufacture of lead dust, dated tenth month, third, 1919, and signed by me, E. W. S., by my initials, and in my writing. I recognize that as my personal signature, by initials. I recognize this third document as Kershaw's notes but I don't know the exhibit number. Here's the date—seventh month, twenty-four, 1917.

Re-cross-examination.

By Mr. Whitcomb:

I haven't the least idea when I first knew about Mr. Kershaw's memorandum of 7-24-17; probably near the time he wrote it. Probably at the time he wrote it, yes. I think it was, but I have no definite recollection of it.

Willard H. Reinhardt was called as a witness on behalf of defendant and, having been first duly sworn, testified as follows:

Direct-examination.

By Mr. Morris:

I am connected with the Willard Storage Battery Company. My office is at Cleveland, Ohio. I have been connected with the Willard Storage Battery Company since June 10, 1918. My position with the Willard Storage Battery Company is chief engineer. As chief engineer I have supervision over research and

development work, design and inspection and testing of the product and materials.

The papers marked Defendant's Exhibit number 81 were handed me some time in 1920 as my instructions for operating the German lead dust mill. That was the designtaion that was given this mill from the time that we started to operate it, the mill we operated in Cleveland. The mill came from Philadelphia, the Electric Storage Battery Company. I find the following instructions that pertain to its operation in the letter to Mr. Norberg signed Edw. W. Smith by Mr. DuBois. (Reading) "I am sending you herewith a few notes on the subject of lead dust manufacture, some of them by our laboratory and a few others of rather more general character by myself—" I did examine those papers prior to our operation of that mill. I likewise examined the third paper, which was shown to be Mr. Kershaw's notes of seven, twenty-four, 1917, before we began the operation of the mill. Then we built a special building in Cleveland and started to operate it the latter part of May, 1920. It was the mill that I mentioned before as the German mill. I have some drawings which will show what the mill consisted of. At the same time the instructions were handed to me, there was handed to me a blue-print with the designation S. F. 1176. I have a photostat of the blue-print. This (tendered by counsel) is the original. It represents the mill which we were instructed to operate.

(Blue-print S. F. 1176, tracing made from Abbé Engineering Company's drawing A-328, dated July 24, 1915, was here offered and received in evidence and marked Defendant's Exhibit number 82; Blue-print 4646-YX, assembly of lead dust mill, Willard Storage Battery Company, was also

offered and received in evidence and marked Defendant's Exhibit number 83.)

I received the paper, Defendant's Exhibit 14, at the same time I received the other information regarding the mill. Defendant's Exhibit 83 is an assembly drawing of the mill that we operated, and this drawing was made by the Willard Storage Battery Company. There is a date here on this photostat, but it is dim, I can't make out what it is. (The original drawing was shown the witness.) This is dated 10-22-19. The next one is the layout for reinforced steel for lead dust building.

MR. MORRIS: I don't think 84 is any good anyhow, and I will withdraw it.

I have examined all of these exhibits from J down to P. Those are correctly labeled with what they are, that is right. The dates on them are not the dates when I received them. Those are the dates when the last ones of these that are marked "Willard Storage Battery Company" were made in the Willard Storage Battery Company's drawing room and the others were the Exide prints and the Abbe Engineering prints, and letters of Mr. Smith and his notes were given to me some time in 1920. All of these prints relate to the lead dust mill that we operated in Cleveland in 1920. We didn't build the mill, it was shipped to us from Exide, but they are the prints from which it was set up and ready for operation. And we used those prints, that is right.

(The following documents were thereupon offered and received in evidence and marked as indicated:

Drawing of Willard Storage Battery Company entitled "Layout of North West Corner

Property—Taft Avenue, Lead Dust House", dated 9-21-19, was marked Defendant's Exhibit number 84.

Drawing of Willard Storage Battery Company, entitled "Steel Details for Lead Dust Bldg.", dated 9-30-19 was marked Defendant's Exhibit number 85.

Drawing of Willard Storage Battery Company, entitled "Details for Lead Dust Mill—Taft Ave.", dated 10-20-19, was marked Defendant's Exhibit number 86.

Drawing of Willard Storage Battery Company, entitled "I Beam Clamp for Chain Hoist", dated 5-7-20, was marked Defendant's Exhibit number 87.

Drawing of Willard Storage Battery Company, entitled "Details for Lead Dust Mill, Taft Ave.", dated 11-20-19, was marked Defendant's Exhibit number 88.

Drawing of Willard Storage Battery Company, entitled "Details for Lead Dust Mill, Taft Ave.", dated 10 23 19, was marked Defendant's Exhibit number 89.)

Coming to the exhibits which follow in my book, there is in these, the remainder of these exhibits, a report from the mill operator on the output and input of the machine and the temperatures, and in some cases deliveries of oxide to pasting department.

(Counsel for defendant thereupon offer in evidence paper entitled General Factory, Department Dust Mill, dated 8 19 and 8 20, which was received in evidence and marked Defendant's Exhibit number 90, and shown to the witness.)

This is a report prepared by the mill operator cov-

ering the time of 8-19-20 to 8-20, beginning at 6:30 A. M. on 8-19, and it gives the amount of lead balls added to the machine, and the amount of litharge produced, and the temperatures every hour. There is also a note there on the time lost during the day.

(Counsel for defendant offered in evidence page from mill operator's notebook, dated 8-19 and 8-20, which was received in evidence and marked Defendant's Exhibit number 91 and shown to the witness.)

That is a photostat of the operator's own notebook covering the operations of the mill. The dates are specified there somewhere. "Out" and "in" on the first sheet means the amount of material out of the mill and amount of material in, that is pounds of balls. Those are some other person's notebooks. They were made under my supervision, and from this notebook that he had here he made these daily reports which were delivered to my office. They constitute a part of my company's records.

(Counsel for defendant offered in evidence tabulation entitled "Lead Dust", covering dates from 6-22-20 to 8-25-20, which was received in evidence and marked Defendant's Exhibit number 92 and shown to the witness.)

These two sheets disclose a summary of our operations for the time that we operated the mill. I think it might be well to explain, take 6-28-20. The top is headed "Pellets added to the machine"; the next column is litharge. The top, the first column after the date, is "Pellets in Machine". That means pounds, not number of pellets. That is what he put in during the time that the machine was operated. The next col-

umn is litharge from the machine, it is headed "Litharge from Machine", 1056 pounds. And the next column is load of the machine, that is, the amount of material that we calculate that is in the machine at that time, and the next column is the average temperature, it is the average of the hourly readings; and the next column is the number of hours that the mill was operated, and the last column is output in pounds per hour. The last figure on the second page is 56.3. That is beneath the notation "Average output per hour". Nothing else on either of those two sheets requires any explanation.

(Counsel for defendant thereupon offered in evidence paper entitled "Willard Storage Battery Company, Chemical Laboratory Report, Text No. 1496", which was received in evidence and marked Defendant's' Exhibit number 93, and shown to the witness.)

Apparent density as given there is grams per cubic inch. And you have to divide that by 16.38 to transpose it into grams per cubic centimeter, the apparent specific gravity. I don't have those several items in terms of PbO on my notes. This is the chemical analysis of the product of the mill, produced on that particular day. I have those calculations in my portfolio there if somebody will hand it to me. (A paper was shown to the witness.) From the total lead analysis on the sample of 8-11-20, we find that calculating the oxidation in terms of PbO we have 87 per cent, for the first line. The second line is 71.7. The third line is 89.5. The next line is 66. The next line is 74.5; the next to the last line, 89.5; the last one 80. That is percentage of oxidation calculated as PbO.

(Counsel for defendant offered in evidence a

paper entitled "Test Instruction Sheet, Engineering Department, Test No. 1496", dated 7-30-20, which was received in evidence and marked Defendant's Exhibit number 94.)

That is a test instruction sheet issued by myself on 7-30-1920, authorizing the chemical laboratory to make—that is the one on which the last exhibit was made.

(Counsel for defendant offered in evidence a paper entitled "Test Instruction Sheet, Engineering Department, Test No. 1175", dated 6-5-20, which was received in evidence and marked Defendant's Exhibit number 95.)

That is a test instruction sheet authorized by myself, dated 6-5-1920, authorizing the chemical laboratory and the experimental laboratory to conduct tests of batteries the negative plates of which were made entirely of lead dust.

(Counsel fer defendant offered in evidence a paper entitled "Test Instruction Sheet, Engineering Department, Test No. 1300" dated 6-30-20, which was received in evidence and marked Defendant's Exhibit number 96.)

That is a sheet containing other instructions from me personally. That KOH is a designation that we have for some inert materials and other materials commonly termed as expanders. LD refers to lead dust and KOH refers to the expander used in the negative plate. This is just a direction to make these tests. Wherever LD occurs in any of these exhibits, it refers to lead dust. By lead dust I mean the product of the German mill that we operated, the one we got from the Electric Storage Battery Company.

(Counsel for defendant offered in evidence a paper entitled Inter-departmental letter from W. L. Reinhardt, dated 6-23-20, which was received in evidence and marked Defendant's Exhibit number 97.)

That is an inter-department correspondence dated 6-23-20, authorizing the factory to make a full factory negative mix with LD material.

(Counsel for defendant offered in evidence a paper entitled Process Specification sheet of the Willard Storage Battery Company #16-C, dated 7-1-20, which was received in evidence and marked Defendant's Exhibit number 98.)

This is a process specification sheet, #16-C, which became effective July 1, 1920, and which gives the method and proportions to be used in making our various negative mixes at that time. It is the first specification that has included lead dust in the specification. This became a part of our regular factory process. That lead dust means the dust that we produced in our mill. It does not mean the oxides. The oxidation calculated in PbO that we made while we were operating this mill ranged from approximately 44 per cent up to 89 per cent. The initials K. W., something, on the top of Defendant's Exhibit 81, first sheet, are the initials of Karl W. Gasche. He was chemical engineer for the Willard Storage up to February, 1920. This document is dated October 3, 1919. I am not sure whether they came to me from him or from Mr. Norberg. Mr. Gasche is not still with the Willard Storage Battery. He left in February, 1920. He went with several other engineers to establish or found the Westinghouse Union Storage Battery Company. As to the condition of the outside or fixed non-rotating,

jacket or casing when the mill first came to my attention in Cleveland, there was a small hole in the outside of the casing for inserting a thermometer, and a small stack at the top. As I recall, this stack isn't shown on any of our drawings, but, as I recall it, it was about three feet high. Its diameter was somewhere between four and five inches. We did not operate the mill in that condition. We operated it in that condition for only a part of a day. I think if you will look in the operator's log book you will find on the first page there a notation signifying that the mill was closed down for several hours to install a vent pipe. That was on May 25. The original notebook will show that. It is a gray notebook. (A book was shown to the witness.) Yes, that is the book, Defendant's' Exhibit 91. The date that I gave was wrong. It is May 22nd instead of 25th. I will read the entry to which I refer. Here is a notation, closed down for repairs from 10:45 to 11:10 A. M.; then closed down again, 12:15 to 2:45 P. M. Reason for the same, put up safety guard and put on vent for heat regulation. I am quite certain that the pipe was installed, but that is the only written record that we have of it. There was an opening in the top when it was received by us.

We had a man named Russell. He was the chief operator of the mill. He left the Willard Company late in 1920 or early '21. We had a man, Mr. Gasche, K. W. G., that I told you about before.

Regarding what Willard did with the lead dust that constituted the product of the operation of this mill, we first made a few preliminary runs, and then about June 2nd or thereabouts we closed the mill down and made some negative plates and put them on test, and the mill was closed down then until the latter part of June, 1920, until we could find out if the plates were satisfactory.

After we started up the second time, the regular factory process specification mentioned before was issued and we used the material in regular production of plates. We continued that and used up all of the material shortly after it was made. We did reserve about a thousand pounds as a reference sample. It was used up later on. We used the lead dust one hundred per cent, plus the usual expanders.

With respect to pasting, pasting is, first, you mix the material with a satisfactory liquid, until you form a paste. This paste then is forced into a framework called a grid, and then the plates are either dried or pickled, and after that operation they are formed. We used a liquid in pasting, and the complete details and amounts are disclosed in the exhibit. I have the exhibit here.

MR. MORRIS: This has to do with Patent 479, if your Honor please.

Defendant's Exhibit 98 shows 50,350 C. C.'s per thousand pounds mixed.

THE COURT: Well, but, really, isn't the essence of that patent the same thing that all the others are?

MR. MORRIS: I think it is.

THE COURT: After all, it is the powder, isn't it?

MR. MORRIS: That is as I construe it.

THE COURT: The method of pasting these plates I don't think was patented, it really wasn't claimed in this patent, isn't that correct?

MR. WHITCOMB: Pardon me?

THE COURT: Well, I mean, this patent depends on the same thing all the others do.

MR. WHITCOMB: Fundamentally, sure.

THE COURT: That is, it depends on the product claims of the other patents, it is using a certain kind of powder in a perfectly well-known process.

MR. WHITCOMB: Substantially well-known mix, yes.

THE COURT: Well, now, I mean the process, there was nothing patentable, was there, about taking plates and smearing paste on them.

MR. WHITCOMB: No, it hinges on the powder.

THE COURT: What?

MR. WHITCOMB: It hinges on the powder.

THE COURT: Hinges on the powder; I am wondering whether it is necessary to go into the process.

MR. MORRIS: I expect to show the percentage of water—

THE COURT: Yes, it is all right, as far as that goes, but the entire process I do not believe is really in issue.

MR. MORRIS: We thought not, but we thought it desirable to show that the only thing in that patent, if anything at all, was the powder that was being used as the basis for the mix.

THE COURT: Well, I think that that is pretty nearly conceded by the plaintiff.

MR. MORRIS: If it is—

THE COURT: Am I right in saying that?

MR. WHITCOMB: Why, of course, we claim—

THE COURT: It saves a lot of time if it is so, but, on the other hand, don't do it unless—

MR. WHITCOMB: We claim that that is an inventive concept, however,—

THE COURT: What?

MR. WHITCOMB: We claim that that is an inventive concept, however, to use this powder.

THE COURT: Well, it is one of the elements of the combination which go to make up the process.

MR. WHITCOMB: Yes, otherwise that is a true statement.

THE COURT: Well, I think that is right.

I have calculated the amount of water that we used for three hundred grams. It varies between 40.7 and 42 C. C.'s for three hundred grams of the powder. Of course, you must take into consideration that there is additional water added at the end of the mix to make the mix to the proper consistency. They were dried in what was commonly known as a counter current dried, which is a tunnel drier, about two hundred feet in length, that is the plates were dried after we had put the mix on the grid, were dried in the manner I have just specified. The plates that were so made went into regular production. They were sold in the regular course of business.

MR. MORRIS: As Your Honor is advised, we operated a mill in Toronto in January, 1935, when several of plaintiffs' representatives were present, both plaintiffs' and defendant's representatives were present. The defendant handed to plaintiffs' representatives on that day certain blue prints, 1, 2, 3, 4, 5, I think, copies of which we have

here, and they were invited to compare the construction of the mill as operated on January 11, 1935 with those drawings. If they care to stipulate that fact and that those drawings show the construction of the mill in Toronto we will offer those drawings in evidence now. If not, it will be necessary for us to bring a witness from Cleveland or Toronto to show that fact.

THE COURT: Was this the same Willard mill that was taken up there?

MR. MORRIS: No, sir, this mill—may I follow the history, it has been testified to?—was erected in Philadelphia, operated there, and after a certain period of time was sent to the Willard Storage Battery in Celveland, and it was operated there for a time, and then was shipped back to Philadelphia, and then it was put in a storage room and some time, Mr. Smith said he didn't know exactly when, the mill, that particular mill, was disposed of for scrap.

Now, the mill that was operated in Toronto was one of the mills of the Willard Storage Battery Company in regular installation. It was changed, it needed only a few minor changes, but those minor changes were made to make it harmonize completely, with the exception of two of the small perforations in the drum, I think.

THE COURT: Yes, I remember that, but, now where was that mill built? The Toronto mill was built in Cleveland?

THE WITNESS: No.

MR. MORRIS: I haven't any idea where that—

THE COURT: Where was that built?

MR. WHITCOMB: London, some of the parts.

THE COURT: It was installed the first time in Toronto?

THE WITNESS: Yes.

THE COURT: It was not installed anywhere in America?

THE WITNESS: There is a similar one installed in America.

THE COURT: In the United States, I mean.

THE WITNESS: There is a similar one.

THE COURT: I know, but this particular mill has always been at Toronto.

THE WITNESS: Yes, that particular one has always been at Toronto.

THE COURT: I understand.

MR. MORRIS: We had no product of our 1916 operations, and we wanted to produce a product by a like mill—

THE COURT: Yes.

MR. MORRIS: —under like circumstances and like operation.

THE COURT: I understand.

MR. MORRIS: And I want to show by these drawings that the mill at Toronto did correspond in all particulars with the Philadelphia mill, the drawings of which have been produced.

THE COURT: Well, all you can ask them to say is that the drawings that they handed you are correct drawings—

MR. WHITCOMB: Of the Toronto.

THE COURT: —of the Toronto mill. Is that all right?

MR. WHITCOMB: Yes, I think we probably can go that far.

MR. MORRIS: You have those copies, haven't you?

MR. WHITCOMB: Sure.

MR. MORRIS: No, I am not asking you to go any further than that.

THE COURT: Well, you can think these two propositions over. Is there anything else you think can be eliminated by stipulation?

MR. MORRIS: It can be stipulated, I assume, that Dr. Wilson took samples of the run at Toronto on January 11, 1935, and that those samples were distributed between the respective parties.

MR. WHITCOMB: Sure.

THE COURT: That can be stipulated right away.

Cross-examination.

By MR. WHITCOMB:

The practice of the Willard Company concerning any drawings made compared with the structure that is made from the drawings is that they usually correspond. There might be some minor details that are not in the drawing. I wouldn't say that it was common practice to have differences. I would say the common practice is to have them accurate. It is usually the plan to have them conform to the Nth degree, as it were, but as construction progresses there

might be some changes that are not recorded on the drawing. I believe this drawing, Defendant's Exhibit 83, was made after we received the mill from Philadelphia. (The drawing was shown to the witness.) I can't see the date of that drawing from here. (The original was shown to the witness.) 10-22-19, October 1919. I am not positive but I imagine that was after we received the mill from Philadelphia. As I recall it, there was a small pipe extending two or three feet above the mill when we received it. It did not extend to the roof. For a few preliminary runs we operated it inside the building to test out the motor and things of that sort. I saw it run. After that the pipe was completed and run to the outside. There was a damper in it. That was right over the mill. The purpose of that was for heat regulation, the regulation of the temperature in the mill. The size of the pipe was between four and five inches in diameter, as I recall it. Referring to Plaintiffs' Exhibit 43, any material being made was passing down and any air was passing the other way. If you had too much draft, or, in other words, if you had a high stack, which would create a draft, there is a possibility that you might lift some of the finer material. Our stack was not that high. I don't believe we had enough draft to force very much out. There was a little that would leak out on the second floor of the mill building at times.

I believe there were five oxides of lead listed in the literature. The first one is lead suboxide. The chemical formula is Pb_2O. The next one is lead monoxide, commonly called litharge, PbO. The next one is sesquioxide, Pb_2O_3, I believe. The next one is red lead Pb_3O_4. The next one is lead peroxide, PbO_2. I imagine I have known them as such since 1918 or 1919. I know about that in general but not so specifically when I went to the Willard in 1918.

Re-direct examination.

By Mr. Morris:

I am not positive that there are five oxides of lead. I referred to finding five oxides of lead in the literature. I don't deem myself sufficiently of an expert to be able to say whether or not there is a substance in existence which is Pb_2O. I don't really consider myself competent to state what the composition of this powder was, the chemical composition. My testimony with respect to that has been not what it contained but what it contained if calculated as PbO.

When the mill that we received from Philadelphia was run with the stub stack on it, we got plenty of lead dust, fine lead dust, out in the room. Some dust did go up the stub stack that we had.

Mr. Whitcomb: We will stipulate, your drawings were correct as to the Toronto plant.

The Court: You haven't yet, you said you were going to think over the stipulation.

Mr. Whitcomb: The drawings, we don't say they are the same as the other plant, we say the drawings—

The Court: All right, let's get that much on the record anyhow.

Mr. Whitcomb: We say they are not.

The Court: That is all right.

Mr. Morris: I am going to prove what they are, so I now understand that it is stipulated by and between counsel for the respective parties that the following drawings truly and correctly represent the mill that was operated by defendant at Toronto, Canada, on January 11, 1935, some of

the product of which was distributed by Dr. Wilson to the respective parties and has been referred to and will be referred to in this case as the Toronto product.

MR. WHITCOMB: Yes, subject to any error that might actually occur.

MR. MORRIS: Oh, yes. Now, will you check these with me?

THE COURT: That is so stipulated, and you said the following exhibits.

MR. MORRIS: I am going to offer them right now. That is A, B, C, D, and E in my book.

(Discussion off the record.)

MR. MORRIS: The drawings showing the Toronto mill as used by us are offered in evidence as Defendant's Exhibits 99 to 103, inclusive.

(Blue print of Willard Battery Company, entitled "Lower Hopper and Discharge Chute", dated 12/17/34, was marked Defendant's Exhibit number 99.

Blue print of Willard Storage Battery Company of Canada, Limited, entitled "Perforated Revolving Drum with Screen", dated 1-9-35, was marked Defendant's Exhibit number 100.

Blue print of Willard Storage Battery Co. of Canada, Limited, entitled "Perforated Revolving Drum with Screen", dated 1-9-35, was marked Defendant's Exhibit number 101.

Blue print of Willard Battery Co., Toronto, Canada, entitled "Number and diameter of holes checked by C. A. Hall, H. B. Lockwood", dated

12-17-34, was marked Defendant's Exhibit number 102.

Blue print of Willard Storage Battery Co., Toronto, Canada, for Natural Draft Vent and Quadrant and Butterfly Valve, dated 12-17-34, was marked Defendant's Exhibit number 103.)

(The witness resuming testified):

I have a copy of the sheet that you gave me this morning. I have compared the drawings, Defendant's Exhibits 99 to 103 inclusive, just offered in evidence, showing the structure of the Toronto mill, with the drawing of the German mill as used by me and I will tell you what difference in mechanical structure I found. The Abbe drawing does not show a stack on our German mill. That is right. In essential details it truly represented the German mill otherwise. There was a very small difference in the number of holes. For example, in the Canadian mill there were 1480 holes and the old German mill had 1482 in the drum cylinder itself. There was a difference in the number of rows of holes also. The Canadian mill had 88 rows of holes and the German mill had 52. In the Canadian mill we had 48 rows of 8 holes each, and 24 rows of 27 holes each, and 16 rows of 28 each, while in the German mill we had 26 rows of 29 holes each and 26 rows of 28 holes each.

The diameter and length of the cylinder as far as we are able to determine from the prints, were identical.

The small end of the hole is identical, that is, .116 inches, and the top, there is a slight variation there, the large end of the hole in the Canadian mill was 13/32, while—did I say Canadian, or German?

Q. Canadian.

These holes are somewhat tapered in the inside portion there where the lead balls are. This same dimension on the German mill was 4/10 of an inch. On the other it was 13/32. The Canadian mill had no manholes or things of that sort on the sides for inspection, while the German mill had one man hole and one hand hole. These were closed during operation. The vent pipe which extended out through the roof was ten inches in diameter, while my recollection of our own vent pipe was between four and five inches, the Canadian mill. Our vent pipe was vertical over the drum while the Canadian was sloping. The delivery pipe from the shell to the container or the receiver for the oxide was eight inches in diameter on the Canadian mill while our pipe was six inches in diameter, and the inside diameter of the trunnion on the Canadian mill was ten inches, and the old German mill, seven inches.

Now, the delivery hood over the lead dust receptacle in the Canadian mill had one hole with a sliding shutter, while the German mill had two holes with rotating slides. I don't believe I know what the respective area of the aggregate of the one hole in the Canadian and the aggregate of the two holes in the mill used by us. I did not find any other mechanical differences in the two structures. I do not find any functional differences in the two machines.

Re-cross-examination.

By Mr. Whitcomb:

Comparing the area of the vent pipe in the Toronto with the so-called German mill, if one is ten inches in diameter in Toronto and four or five in the German, the cross-sectional area will be approximately four times as much. It varies as the square. If it is five

inches you would have twenty-five in the German and one hundred in the Canadian. I just pointed out the differences in these trunnions. The trunnion is the opening where the material is fed into the mill. I just pointed out that that was a difference between the two mills. There was a larger opening in the Toronto mill than in the German mill. A ratio of ten inches to seven inches in diameter and the question of area would be the same, vary as the square rather than the mere straight difference.

We did not make any attempt to collect the dust in the room or in the roof at the Willard plant. It was not significant enough.

Re-direct-examination.

By Mr. Morris:

There was a damper in the Canadian vent pipe or stack as well as a damper in our Cleveland mill. The effect of those dampers would be to regulate the amount of air through the mill. It is possible that we could get the same amount of air through our ten inch sloping Canadian stack by our damper as we got through our five inch vertical stack in our German mill. You can damper them down so that you can get the same amount of air through either one. You could get four times as much through the ten inch stack as through a five inch stack, other conditions being the same. The trunnion openings were closed in each case. Of course, there was slight leakage around.

Re-cross-examination.

By Mr. Whitcomb:

The Willard plant now manufactures some and buys some oxides. We have Hardinge mills similar to the ones in Philadelphia. At the moment I can't tell

you whether we now have six or eight. I think those were put in in 1928. We installed the whole equipment as many as we have now, at one time. Before that time we purchased some of our oxides from the Electric Storage Battery Company in Philadelphia. The ratio of the amounts we purchased compared with the amounts made from the German mill probably was not as high as one hundred to one at that time. It was hardly that big. I would say probably—well, I don't really know. There wasn't a large portion of our production.

THE COURT: That is a question that nobody has answered, and it might be of some importance.

MR. WHITCOMB: Yes, I called for figures.

THE COURT: Well, you can't get even a guess out of anybody on the matter of what proportion of the total requirement were made by these mills.

MR. MORRIS: Well, we will give you those figures—

THE COURT: Well, all right.

MR. MORRIS: —if you want them.

THE COURT: I don't know whether it is important, or not.

MR. WHITCOMB: We have asked for them. We want them.

MR. MORRIS: My thought about the situation is this. We concede freely that the product that was bought by us in 1916 and 1918 was many, many times as great as that that was being manufactured by the German mill. We hadn't come with those figures, and I think the witnesses are correct in not guessing. Your Honor doesn't want guessing.

THE COURT: Well, maybe they are, I don't know. I just suggest. I don't know whether it is even important or not, but it might be, and it just seems to me that is one question that you just get absolutely nothing from.

MR. MORRIS: Well, we don't know, our people don't know. We haven't looked up what our production was in those years.

THE COURT: Well, it is all right. It seems to me they must know whether it is three times, or a hundred times, or a thousand times, they must know more than they say.

MR. MORRIS: No, but they are guessing—

THE COURT: I don't know how much—

MR. MORRIS: If they would give an answer it would be a pure guess.

THE COURT: Well, maybe so.

MR. MORRIS: I will give you the figures.

THE COURT: All right.

MR. MORRIS: Or, again—well, we will give you the figures.

I don't know the exact date when the mill was shipped back to Philadelphia. I don't know the approximate date, it was, as I recall it, some time in 1921. From 1921 to 1928 we purchased all our oxides.

Re-direct-examination.

By MR. MORRIS:

If you had a Shimadzu mill and it had all the advantages that are given to it in patent '149, producing a hundred kilograms a hour, it would have taken

approximately four of those mills to produce a thousand pounds of powder an hour. A Hardinge mill can turn out somewhere between eleven hundred and twelve hundred pounds an hour. So that even if you had had the best Shimadzu mill, it would have taken four of them to equal one Hardinge mill and then four wouldn't have been quite as good as one. There are approximately two and a half pounds of powder to a kilogram, if my memory is right. I don't know that any Shimadzu mill would turn out a hundred kilograms per hour if made in accordance with the specification of the patent and operated in accordance with that specification.

Re-cross-examination.

By Mr. Whitcomb:

I don't know that it would not.

William Ernest Kershaw, a witness on behalf of defendant, was recalled.

Re-direct-examination.

By Mr. Morris:

(Notebook containing pages marked Defendant's Exhibit 16, 17, was shown to the witness.) The third page from the end of it contains a note which is in my handwriting. It shows the date of the employment of Mr. Benjamin Shablin, it reads, date employed, 7-3-16.

(The page from the notebook of the witness Kershaw was thereupon offered and received in evidence and marked Defendant's Exhibit number 104.)

I have made a comparison similar to that made by Mr. Reinhardt between the Toronto mill and the German mill operated by us in Philadelphia. I find the same mechanical differences as those testified to by Mr. Reinhardt. I find no functional difference. The Toronto mill was operated under my direction. It was so operated on January 11, 1935. We have a log sheet of that day.

(Counsel for defendant thereupon offered in evidence the following exhibits, which were received and marked as indicated:

(Records of Toronto mill for January 9, 1935 were marked Defendant's Exhibit number 105.

Records of Toronto mill for January 10, 1935 were marked Defendant's Exhibit number 106.

Records of Toronto mill for January 11, 1935, were marked Defendant's Exhibit number 107.)

The witness, resuming, testified:

I recall that representatives of the plaintiff were present.

MR. MORRIS: Can we stipulate, Mr. Whitcomb, that you and who else on your side were there on January 11th?

MR. WHITCOMB: Do you want all the men listed? It is all right.

MR. MORRIS: Well, you had your technical men and legal—

MR. WHITCOMB: Mr. Wood, Mr. Newton, since deceased,—

MR. MORRIS: Mr. Newton, of counsel, Mr. Souther, of counsel, Mr. Wood, a chemist from USL, Mr. Betts, of counsel. Who is Mr. Reid.

MR. WHITCOMB: He is a chemist.

MR. MORRIS: Mr. Reid, a chemist, Mr. Whitcomb, Mr. Ishimura, and Mr.—

MR. WHITCOMB: Yamaoka.

MR. MORRIS: Mr. Yamaoka, for plaintiffs, and the defendant also had its—

MR. WHITCOMB: We don't know the defendants so well.

MR. MORRIS: I see. The defendant, of course, had its representatives there. Mr. Kershaw was one.

MR. WHITCOMB: That is an error, Mr. Betts is of counsel, not a chemist. You read it as chemist.

MR. MORRIS: No, I think Mr. Wood is chemist.

MR. WHITCOMB: Mr. Reid, Mr. Wood, and Mr. Betts is a lawyer.

MR. MORRIS: Of course, Mr. Betts, of counsel, and I apologize if I referred to him as chemist.

(The following exhibits were thereupon offered and received in evidence and marked as indicated:

(Laboratory test of run of Toronto mill of January 11, 1935 were marked Defendant's Exhibit number 108.

Records of operation of lead dust mill in Toronto for January 9th, 10th and 11th, 1935 were marked Defendant's Exhibit number 109.)

The witness, resuming, testified: Comparing the method of operation of the Toronto mill as run on those days and particularly on January 11, 1935, with our method of operating the German mill in Philadelphia in 1916, 1917 and 1918, we operated at Toronto as closely in accord with the method of operation formerly employed at Philadelphia as we could. The temperatures, revolutions and output, ventilation, and so forth, was held within close approximation to what we had run in the German mill. In order to do that I had some of the records of the previous runs of the German mill, which have been offered as exhibits, with me for the purpose of comparison. The logs of the respective runs will show the comparison to which I am testifying. They are in reasonably close agreement.

Re-cross-examination.

By Mr. Whitcomb:

I am connected with Exide. I have been continuously since 1906.

Q. Please refer to Defendant's Exhibit D-80, and it seems we find duplicate runs for the same week, and explain what that is. Have you got yours?

A. I have mine. Can you tell me what week you are referring to?

Q. 8-28 to 9-2, 1916, on the tab, it is about the third sheet from the top, third and fourth.

A. Without taking too much time to compare them—

Q. Well, take all the time you want.

A. —item by item, it appears they are duplicates, with the exception that the second record in my folder has been carried a little further in regard to the equivalent weight of balls per hour than the first record.

Q. Well, how does it come there are two?

A. One of those is in Kahn's handwriting, and the other one is in mine, but I can't explain otherwise why there are two. I suppose we both made out records independently and they got in the folder.

Q. As a matter of fact, they are not exactly the same, are they?

A. No, they are not exactly the same.

Q. Do you have a chart corresponding to Exhibit 109 for the operation—

A. I have a print of it, yes, sir.

Q. Have you a chart corresponding to that for the early mills?

A. There is no single chart, but the comparison is made between this and a number of charts of the early mill.

Q. Well, do they appear on this chart?

A. They do not, no.

Q. Well, have you got those others?

A. I am not sure—

Q. In other words, you presented one-half of a comparison, namely, what you did in Toronto. Now, have you got the charts for what you did in Philadelphia?

A. I don't know whether they are here. Such charts have been made, and as far as having the other record, you can make the comparison yourself, if you choose.

Q. But you haven't got them here?

A. I personally haven't got them. They may be in our files, I am not sure.

Q. Will you produce those if you can find them before the case is closed?

Mr. Morris: What chart is it you want?

Mr. Whitcomb: Comparison chart for the

operation in the Philadelphia mill compared to this Exhibit 109.

MR. MORRIS: That is, I understand that, Mr. Whitcomb, what you are asking for is a comparison chart.

MR. WHITCOMB: Yes.

MR. MORRIS: That is, where the charts were made separately, I mean, where the Philadelphia mill and this mill were put on the same sheet, is that what you mean?

MR. WHITCOMB: If that is the case. He said they were, he said he had charts.

MR. NORRIS: I don't whether—I think not, I think we had a chart showing a comparison on the same sheet of one week's run of Philadelphia. I thought that was not a fair comparison, because anybody can make the comparison by every weeks' run made in Philadelphia with our Toronto mill. I, therefore, have not produced any drawing of that kind, because it is not a full, could not in itself be a full disclosure. I will give you that week's drawing, if you want it, if I still have it. I don't know whether I have it or not. Do you want it?

MR. WHITCOMB: Well, we want the one the witness has referred to more than we want yours. The witness says he may have some—

The witness, resuming, testified: I said I have none here. I think I will have in Philadelphia and I think our counsel has a copy of one of them.

MR. WHITCOMB: Well, those are the ones we would like to see.

MR. MORRIS: Here is the one to which I have referred, and it is the only one I have seen.

(Mr. Morris produced a paper.)

(The witness examined the paper.)
This is the one I mean.

(Counsel for plaintiffs thereupon offered in evidence as Plaintiffs' Exhibit 45 comparison chart of operation of Philadelphia and Toronto mills, which was marked Plaintiffs' Exhibit number 45 for identification.)

As far as my knowledge and belief goes, the apparatus covered with a canvas at Toronto has nothing whatever to do with the operation of the Toronto mill under myself. I can't say whether the material was taken off of the mill in order to change it to make it run. Some material was taken off. I could see where it had been detached.

I can quote the textbooks as to what the oxides of lead are. Without the textbooks, I would say that the five oxides of lead are: lead suboxide, lead monoxide, that is litharge, lead sesqui-oxide, red lead, and lead dioxide or peroxide. I would so have listed the oxides of lead if asked a similar question in, say, 1920.

Re-direct-examination.

By MR. MORRIS:

I do not deem myself competent to say whether there is any such compound as suboxide of lead. It is a question which I cannot answer on account of limited knowledge. I would not say it is impossible to determine whether there is lead suboxide.

Defendant's evidence suspended.

Plaintiffs' evidence resumed.

GEORGE L. CLARK, a witness on behalf of plaintiffs, was recalled.

Re-cross-examination.

By MR. MORRIS:

Q. Dr. Clark, on pages 396 and 397 of the record, and particularly on 397, I find that you answered thusly in reply to this question of mine, which began on 396; "Q. Now, did you make any X-ray patterns, diffraction patterns, for any products other than those disclosed as Exhibit 21?"—Exhibit 21 being what looks like a shelf of books of the fourteen patterns. You replied: "A. Yes, those, the actual films are in evidence for many more samples than that, and then, of course, we have made, as I said, in the course of this whole investigation possibly five hundred exposures.

"Q. What other products did you analyze spectographically—would that be a correct term? No, it isn't—by the X-ray process?

"A. By diffraction method, yes.

"Q. Diffraction method.

"A. Well, as I said yesterday, we did about one hundred and twenty-five lead oxalate experiments, and, of course, we have had a large number of samples. . . ."

Later, I asked for the production of those measurement sheets or work sheets, and day before yesterday Mr. Shaffer was good enough to hand to me a few sheets of paper, and I agreed with him that he could retain them and get them photostated so that we could have copied them, but my question was to produce the documents which you sent in reply to my request for your work sheets in connection with your diffraction work in this case.

Shall we start with any particular one, and tell me what it is so that I can mark it on my copy?

A. All right.

Q. Will you take out one and let me see which it is?

A. We might start with this one, "Corrected and revised measurements of spacings."

Q. Corrected and revised measurements of spacings.

MR. MORRIS: Which we will offer in evidence as Defendant's Exhibit—

MR. WHITCOMB: We would be glad to introduce them. Is there any objection to splitting them up?

MR. MORRIS: Not at all. I will introduce—

MR. WHITCOMB: Plaintiffs' Exhibit 46—is that all right with you? I will introduce it.

MR. MORRIS: I don't care at all, let us get them in some order.

MR. WHITCOMB: Yes. Would you like me to introduce all the exhibits he has produced?

MR. MORRIS: No, not particularly.

MR. WHITCOMB: You will have a number on each one.

MR. MORRIS: They will have your number or we will have my number, I am not concerned about that. Do you want to introduce them?

MR. WHITCOMB: Yes. Counsel for plaintiffs offers in evidence as Plaintiffs' Exhibit 46, sheet, "Corrected and revised measurements of spacings, highest accuracy."

(Paper headed "Corrected and revised meas-

urements of spacings, (Highest Accuracy)" was marked Plaintiffs' Exhibit Number 46.)

THE COURT: Let me just see what it looks like.

(Plaintiffs' Exhibit Number 46 was handed to the court.)

MR. WHITCOMB: Counsel for plaintiffs offers in evidence as Plaintiffs' Exhibit Number 47, the next sheet produced by the witness which is—

THE WITNESS: Tabulation of spacings for—lead oxide, lead and lead suboxide.

(A paper headed "Tetragonal PbO" was marked Plaintiffs' Exhibit Number 47.)

MR. WHITCOMB: Counsel for plaintiffs offers in evidence the next sheet produced by the plaintiffs' expert, and asks the clerk to mark the same Plaintiffs' Exhibit 48, which is—

THE WITNESS: Experimental tabulation pattern for pure lead.

(A paper headed "Pb" was marked Plaintiffs' Exhibit Number 48.)

MR. WHITCOMB: Counsel for plaintiffs offers in evidence the next sheet produced by the plaintiffs' expert witness and asks the clerk to mark the same Plaintiffs' Exhibit Number 49, which is—

THE WITNESS: Experimental tabulation of tetragonal PbO.

(A paper headed "PbO" was marked Plaintiffs' Exhibit Number 49.)

MR. WHITCOMB: Counsel for plaintiffs of-

fers in evidence the next sheet produced by the witness—

THE WITNESS: The same for silver oxide.

MR. WHITCOMB: —and asks the clerk to mark the same Plaintiffs' Exhibit 50.

(A paper headed "Ag_2O" was marked Plaintiffs' Exhibit Number 50.)

MR. WHITCOMB: Counsel for plaintiffs offers in evidence—

THE WITNESS: Same for cupreous oxide.

MR. WHITCOMB: —and asks the clerk to mark the same Plaintiffs' Exhibit 51.

(A paper headed "Cw_2O" was marked Plaintiffs' Exhibit Number 51.)

MR. WHITCOMB: Counsel for plaintiffs offers in evidence the next sheet produced by the witness, which is—

THE WITNESS: Comparative measurements with Ferrari's results, Pb_2O.

MR. WHITCOMB: —and asks the clerk to mark the same Plaintiffs' Exhibit Number 52.

(A paper headed, "Comparison and calibration for Pb_2O in Exide, Prest-O-Lite, oxalate" was marked Plaintiffs' Exhibit Number 52.)

MR. WHITCOMB: Counsel for plaintiffs offers in evidence the next sheet produced by the witness which is—

THE WITNESS: Page 8 of the research log, and complete tabulation of fractionated Exide sample.

MR. WHITCOMB: —and asks the clerk to mark the same Plaintiffs' Exhibit Number 53.

(A paper headed "Research log, fractionated Exide Sample" was marked Plaintiffs' Exhibit Number 53.)

MR. WHITCOMB: Counsel for plaintiffs offers in evidence the film—

THE WITNESS: The next is a special nickel filtered copper pattern, copper radiation pattern for the fractionated sample of Exide.

MR. WHITCOMB: —referred to—.

THE WITNESS: Referred to on that sheet.

MR. WHITCOMB: Exhibit Number 53.

THE WITNESS: Yes.

(An envelope containing a film entitled, "Special nickel filtered radiation" was marked Plaintiffs' Exhibit Number 54.)

MR. WHITCOMB: Counsel for plaintiffs offers in evidence the film produced by the witness which the clerk has marked Plaintiffs' Exhibit Number 54. The next—

THE WITNESS: The like pattern of fractionated sample of Exide, finest fraction of Exide material from which the preceding film was made.

By MR. WHITCOMB:

Q. In your opinion, this is what?

A. That gives the pattern corresponding to what we claim as suboxide.

MR. WHITCOMB: Counsel for plaintiffs introduces the film—

THE COURT: That is it, is it?

THE WITNESS: That is it.

MR. WHITCOMB: —and asks the clerk to mark the same Plaintiffs' Exhibit Number 55.

(A glass tube with a label marked (fractionated samples) was marked Plaintiffs' Exhibit Number 55.)

MR. WHITCOMB: The next sheet produced is—

THE WITNESS: Page 12 from the research log, calibration of the camera for the preceding—

MR. WHITCOMB: —and asks the clerk to mark the same Plaintiffs' Exhibit Number 56.

(A paper headed "Complete tabulations for C83 film," was marked Plaintiffs' Exhibit Number 56.)

THE WITNESS: Calibration of camera Number 3, with the lead, using constancy for metallic lead, offered by Professor W. P. Davey, I think.

By MR. WHITCOMB:

Q. Who is in the court representing the defendant?

A. Yes.

MR. MORRIS: And will testify for defendant?

THE WITNESS: Well—next is a calibration curve for reading spacings quickly directly from linear displacements of lines on films. The camera being the one used for the D samples, the Exide samples.

MR. WHITCOMB: Counsel for plaintiffs of-

fers in evidence the curve and asks the clerk to mark the same Plaintiffs' Exhibit Number 57.

(A paper headed "Curves for reading spacings directly from linear displacements of lines" was marked Plaintiffs' Exhibit Number 57.)

THE WITNESS: The next is several sheets from rough sheets from a progress report simply illustrating the general precautions as first used in this work, calibration and so on.

MR. WHITCOMB: Counsel for plaintiffs offers in evidence the sheets produced by the witness and asks the clerk to mark the same Plaintiffs' Exhibit Number 58. (Progress report—14 sheets.)

MR. WHITCOMB: The next sheet—

THE WITNESS: Next sheet is a calculation sheet for a particular film, C83 similar to the B.

MR. WHITCOMB: Counsel for plaintiffs offers in evidence the sheet produced by the witness and asks the clerk to mark the same Plaintiffs' Exhibit Number 59.

THE WITNESS: Film having been aged and exposed. Exide sample exposed to air, that pattern being made the twelfth of September, 1935 showing the absence of even traces of lead suboxide.

By MR. WHITCOMB:

Q. What film is that?

A. Sample exposed to air. This is an Exide sample corresponding to DIF which has been left open in the air.

Q. Is there something in the record to compare this with?

A. Yes.

MR. WHITCOMB: Mark it for identification as Plaintiffs' Exhibit Number 60.

(Aged & exposed Exide sample.)

THE WITNESS: I would like to introduce—

MR. MORRIS: You don't introduce anything. I have never seen that.

THE WITNESS: No.

By MR. MORRIS:

Q. It has not been hitherto produced for my inspection?

A. No.

Q. All the papers that have been produced by you pursuant to my request are the ones which now have been marked in evidence as plaintiffs' exhibits?

A. Yes.

MR. MORRIS: I am not concerned with what you produced after that, but I want to know where the papers furnished me stop.

Is there anything more you want?

MR. WHITCOMB: He has them there, we are willing to have them, but, to date, I don't know whether either side wants them.

By MR. MORRIS:

Q. Dr. Clark, I dont' know whether I want them or not, but I did ask you for all your work sheets and anything bearing on this case.

A. Yes.

Q. Have you any work sheets that you have not produced pursuant to my request?

A. No, this particular one here which I am speaking of now deals with measurements, the earliest meas-

urements on long General Electric film by the Hull-Davey method, and long film. They have not been produced in evidence because there have been so much better ones, but they illustrate actual measurements with the General Electric rule of some seven of the earliest samples of lead, lead oxide and so on.

Q. That has nothing to do with any work sheets of your own?

A. Except insofar as that first table that you have, the very first one, is compiled partly from the results of this, although this is not absolutely essential.

Q. You mean compiled partly from the knowledge you gained from the documents you now have at hand?

A. Yes.

Q. But what I want to get, Doctor, please, is whether these documents that you have before you now, introduced by the plaintiffs in evidence, constitute all your work sheets done in connection with this work in this case. Am I to understand that to be the fact?

A. All that I have, yes. Of course, this—

Q. That is not my question. I understand what we have are work sheets—

A. Yes.

Q. —but I don't understand whether or not I have your work sheets. I am not trying to look at the Toronto record, let us forget that.

A. Yes, sir.

Q. There is no objection to using it in rebuttal if you want to put it in, but I am not fishing for it now. Now, forget about Toronto. Have you any other work sheets?

A. This is the only thing. I didn't know I had it, because it is four or five years old.

Q. So that of the five hundred examinations made, of the five hundred exposures of one hundred

and twenty-five lead oxide experiments you kept no records, made no work sheets save those which have now been delivered into the case right—

A. Yes, sir.

Q. Eliminating Toronto?

A. Yes, and understanding also that the film itself is a work sheet and the microphotometer curves are work sheets and that much of this work has been done with a strong light viewing box and visual comparison.

Q. Tell me what Exhibit 59 is? I see nothing on it to indicate really what it is.

By Mr. Whitcomb:

(The witness examined Plaintiffs' Exhibit Number 59.)

A. This was an analysis of a whole series—I mean a typical analysis from the series C, by the way, of lead oxalate experiments. This was selected for mathematical analysis, and, really, this, the others were simply compared by visual comparison and study.

Q. May I see if I understand you right? That is, in one of your films for C, which is your symbol for lead oxalate—

A. Yes.

Q. —you made these measurements—

A. Yes.

Q. —and calculations and put them on this chart?

A. That's right.

Q. For all other of your oxalate tests you made merely ocular comparisons over that box with the glass top, with the light in it?

A. Yes.

Q. What do you call it?

A. A viewing box.

Q. Frosted glass?

A. Yes.

Q. It is like a reading desk with a frosted glass top and a light so that you can read through it?

A. Yes.

Q. You made that comparison?

A. Yes.

Q. Do you keep a book, Dr. Clark, in which your experiments are transcribed? The record of your experiments are entered?

A. Well, there has been no one single book. Of course, this has been scattered over a long period of time.

Q. Don't you, as a scientist dealing I assume with the, I presume with great accuracy, keep and study data with respect to it, in books either loose leaf or books with leaves that are not loose?

A. Much of it is.

Q. You haven't shown me a single one of those books.

A. There are pages of it found in the research log. In all of this experimental work I have compared the films very accurately and very carefully tabulated so that they could be examined at any time. That constituted a permanent record.

Q. Did Ferrari have Pb_2O?

A. Yes, he did.

MR. MORRIS: I would like to go into it a little bit after luncheon, if we convene then.

THE COURT: Shall we adjourn now?

MR. MORRIS: Yes.

THE COURT: Today we will recess at 12:00 o'clock and come back at half past one.

(Recess from 12:00 o'clock noon to 1:30 o'clock P. M.)

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Vol. II

TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1938

No. 441

THE ELECTRIC STORAGE BATTERY CO.,
PETITIONER,

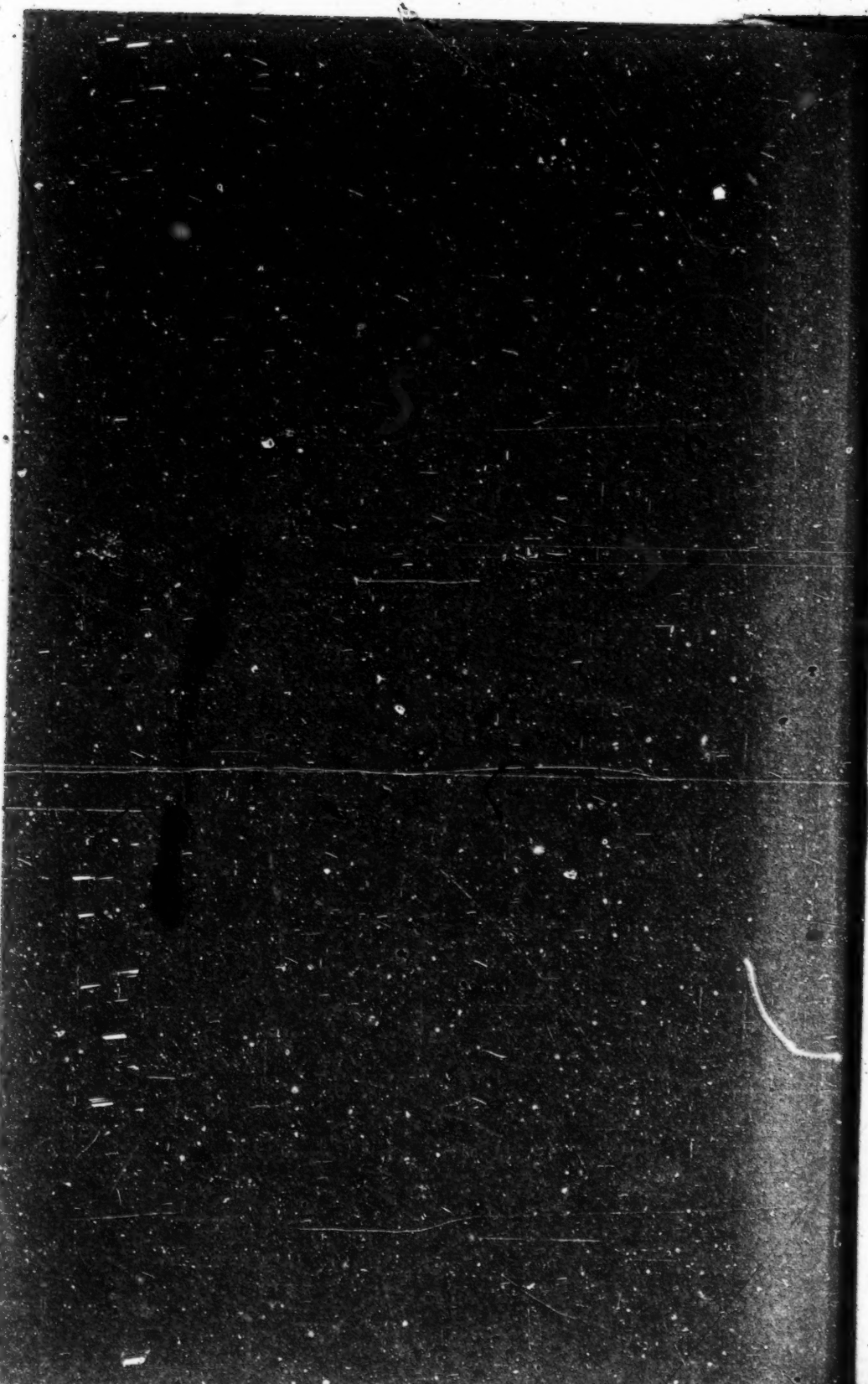
vs.

GENZO SHIMADZU AND NORTHEASTERN ENGINEERING CORPORATION.

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT

PETITION FOR CERTIORARI FILED OCTOBER 27, 1938.

CERTIORARI GRANTED DECEMBER 5, 1938.



INDEX.

	Page
Docket Entries	1
Bill of Complaint	7
Answer of The Electric Storage Battery Company	28
Notice of Motion for Leave to Amend Answer	43
Amended Answer	43
Notice of Motion	44
Motion for Leave to Inspect Defendant's Plant	45
Affidavit of James T. Newton	48
Affidavit of Luyho S. Ishimura	50
Answer to Motion and Affidavits	50
Affidavit of John R. Williams	67
Affidavit of Edward Wanton Smith	70
Affidavit of Clarence A. Hall	72
Affidavit of Joseph Lester Woodbridge	74
Affidavit of C. Reed Cary	78
Affidavit of Edward W. Smith	80
Defendant's Memorandum in Opposition to Plaintiffs' Motion to Inspect Defendant's Plant	80
Defendant's Supplemental Memorandum in Reply to Plaintiffs' Memorandum and Supplemental Memorandum in Support of Plaintiffs' Motion for Inspection	94
Notice of Defendant's Motion for Bill of Particulars	108
Defendant's Motion for Bill of Particulars	109

	Page
Notice of Motion for Leave to file Interrogatories	110
Defendant's Motion for Leave to file Interrogatories after Expiration of Twenty-one Days	111
Interrogatories Propounded by Defendant	112
Interrogatories Propounded by Plaintiffs, Pursuant to Equity Rule 58	113
Motion for Further and Better Particulars of Defenses	115
Defendant's Bill of Particulars	118
Answers of R. C. Norberg to Interrogatories	122
Answers of Northeastern Engineering Corporation and Genzo Shimadzu	123
Plaintiffs' Bill of Particulars	134
Order for Letters Rogatory	136
Order of Amendment	137
Narrative Statement of Evidence	138

PLAINTIFFS' EVIDENCE:

	Direct	Cross	Re-D.	Re-C.
L. S. Ishimura	139	173	185	186
			190	191
			192	192
			196	
George L. Clark	197	276	381	586
			676	686
			688	
George Lane Kyle	383	393	400	400
			401	
William Cooper	401	410	419	423

DEFENDANT'S EVIDENCE:

Edward W. Smith	428	479	516	523
			555	556
Jacob Hoelzle	526	527		

	Direct	Cross	Re-D.	Page Re-C.
Benjamin Shablin...	527	530	530	
George M. Howard..	531			
William E. Kershaw.	532	549	555	
			579	582
			585	
William H. Reinhardt	556	570	572	575
			576	576
			578	578
Richard S. Garton....	688	690		
J. Lester Woodbridge	690	719	724	
Wheeler P. Davey...	727	797	851	
			882	888
			890	895
Harold V. Anderson.	854	876	880	881
			1018	
Warren W. Ewing..	896	940		
Harry W. Ullmann..	959	997		
Clarence A. Hall....	1020	1024		
		1038	1047	
Edward Clocker.....	1035	1035		

PLAINTIFFS' EVIDENCE IN REBUTTAL:

George L. Clark...	1051	1092	1125	1128

RETURN OF LETTERS ROGATORY.

	Direct	Cross	Re-D.	Re-C.
Genzo Shimadzu....	1130	1149		
Suyeharu Uchiyama.	1153			
Tominosuke Hichijo.	1157			

Stipulation 1159

Order 1161

Opinion, Kirkpatrick, J. 1162

Memorandum Amending Opinion after Rehearing, Kirkpatrick, J. 1189

Decree 1192

	Page
Petition for Appeal	1196
Order Allowing Appeal	1197
Assignments of Error	1198
Citation	1205
Petition for Cross-Appeal by Plaintiffs	1206
Order Allowing Appeal	1207
Plaintiffs' Assignments of Error on Cross-Appeal	1208
Citation	1212
Praecipe for Transcript of Record	1213
Physical Exhibits	1216
Clerk's Certificate	1219
Order Assigning Hon. Oliver B. Dickinson for Argument	1221
Reference to Argument	1222
Opinion	1223
Order Affirming Decree	1226
Petition of Defendant-Appellant for Rehearing and Supporting Brief	1227
Order Denying Petition for Rehearing	1255
Clerk's Certificate	1256
Order allowing certiorari	1256

AFTER RECESS.

GEORGE L. CLARK, recalled.

Re-cross-examination (Continued).

MR. MORRIS: Will you pass the witness that Exhibit 21?

By MR. MORRIS:

Q. I hand you, Dr. Clark, Plaintiffs' Exhibit number 21, which is this photostat of fourteen photograms. Will you tell me what number 9 is?

A. Number 9 is the finest fraction of finely divided number three Prest-O-Lite bag oxide.

Q. I wonder if you will repeat that, finer fraction of finely divided number three; number three is tetragonal PbO?

A. Pest-O-Lite bag oxide.

Q. Did Ferrari have any tetragonal PbO lines?

A. In his paper he—the table in his paper, he lists only metallic lead and lead suboxide.

Q. You don't know, then, whether Ferrari had found any tetragonal PbO in his lines, or not?

A. I haven't seen—of course, I haven't seen his films, and there is no statement in the paper to that effect except that the sample subsequently decomposed or changed.

Q. Then your answer to my question is that you don't know?

A. I don't know.

Q. All right.

THE COURT: I wonder if I could have the chart that was made from this with the colored lines. Have you got that available? There was one made, just a chart.

MR. WHITCOMB: We have it.

THE COURT: It was easier to follow. There it is, that is P-28, that is the one.

MR. MORRIS: Have you a copy of that for us? We have never gotten a copy of that.

THE COURT: It is only a working chart that was made from this.

MR. WHITCOMB: We will have them made.

THE WITNESS: That is the original.

By MR. MORRIS:

Q. So number 9 was the finely divided tetragonal PbO?

A. No, that is the—that is the finest fraction from the finely divided Prest-O-Lite.

A. That is the finest fraction of finely divided Prest-O-Lite oxide?

A. Yes.

Q. What is the other?

A. Made by the Shimadzu process.

Q. All right, now, where are your working sheets for that number 9?

A. I don't know whether there are any.

Q. You never took any measurements of this newly-discovered or confirmed Pb_2O?

A. Why, yes, the number 11, the finer fraction of finely divided number 7.

Q. Oh, that is 11?

A. I beg your pardon, number 10, finely divided fraction of number 6 is given in one of the exhibits presented this morning.

Q. Finely divided number 6, well, that is the same as Defendant's 2, isn't it? Isn't that the same as the one you handed me the other day when you were here?

A. Yes.

Q. So that you have your measurements for number 6, Exide oxide?

A. That is right.

Q. But I thought you told me the other day that the lines of number 6 and lines of 9, 10 and 11 do not correspond. Am I right?

A. Number 6 is the mixed oxide right from the mill.

Q. Yes.

A. And number 10 is the finest or the super-centrifuged, non-settling fraction from number 6.

Q. Yes.

A. And in this number 10 is concentrated in its finest fraction.

Q. Yes.

A. A spectrum which—another filtered spectrum was presented this morning of a film which, most of the lines of which correspond to the suboxide or a cuprite type of structure.

By The Court:

Q. Now, is that the blue on P-28, is that the blue?

A. That is right.

Q. That is marked Pb_2O?

A. That is right.

Q. And that is the same as number 10 on your—

A. That is number 10.

Q. On Exhibit 21?

A. Yes.

The Court: All right.

By Mr. Morris:

Q. So that what you did in 9, 10 and 11 was merely to take out what lines that appear in number 6?

A. The lines of lead and tetragonal PbO.

Q. So that there are no lines of lead and tetragonal PbO in 9, 10 and 11?

A. There may be a little in 9, but not in 10.

Q. Not in 10?

A. No.

Q. Any cubic PbO in 9, 10 or 11?

A. Cubic PbO?

Q. Yes.

A. There is no cubic PbO.

Q. Oh, there is not?

A. No.

Q. You know that there is not any cubic PbO?

A. There are two kinds of PbO, tetragonal and orthorhombic.

Q. We know that, but do you know that there is not any cubic PbO?

A. Well, I never have seen any, or never have heard of any, or never found any record of any.

Q. Before Berzelius nobody ever heard of any Pb_2O, either, did they?

A. That is right.

Q. So are you saying that everything, like the Commissioner of Patents in 1849 said, close the Patent Office because everything that there is has been discovered, are you in that position with regard to chemistry—

A. Well, certainly not, as a science.

Q. —and crystallography?

A. Absolutely not.

Q. All right, so that we do know that there is no cubic form of PbO?

A. At present, yes.

Q. But—

A. We don't know of any at present.

Q. Do you mean that there isn't any at present, or you don't happen to know of any at present?

A. I don't know of any cubic PbO, or know of any publication in which anyone has ever discussed any.

Q. What has publication got to do with the existence of cubic form of PbO?

A. Well, I suppose that all of chemistry, the progress of chemistry necessarily depends upon the publication of experimental results.

Q. Surely, you didn't base your experimental results with regard to Pb_2O, say you found that because Ferrari found it?

A. No, sir.

Q. Certainly not. Then did you make no measurements of your lines on 9, 10 and 11?

A. I did.

Q. Where are they?

A. They are in the exhibit, whatever it is, this morning, from our research log.

Q. Well, which exhibit?

THE COURT: Pardon me, I wonder if you would just get me straight on this—

THE WITNESS: All right.

THE COURT: —by just putting the numbers on this thing that correspond with this. Now, that I am all right on, that is number 10.

THE WITNESS: That is right.

THE COURT: Now, what is this?

(The witness indicated the proper marking on the exhibit.)

By MR. MORRIS:

Q. So that the only measurements that you have for number 9, 10 or 11 are found in Defendant's Exhibit 2?

A. No, that is not the one, Judge Morris, I am sorry. It is the plaintiffs' exhibit presented this morning.

Q. Well, now, won't you pick it out—

A. Yes.

Q. —and give me the exhibit number? Perhaps it is 59, I think this is it, isn't it?

A. No, here it is.

Q. What is the number?

A. 53.

Q. 53?

A. Yes.

Q. So that 53 constitutes your measurements for what?

A. That constitutes the measurements specifically on 10. Of course, 9 and 11 were—had been compared directly with number 10 many times.

Q. Well, now, you have, of course, compared these, and there are many figures on them. Are there any lines on Plaintiffs' Exhibit 53 that are not found on Defendant's Exhibit 2?

A. Yes, surely.

THE COURT: I don't know, but I am mixed up in these exhibits. Which is 53 and which is 2?

MR. MORRIS: 2 corresponds to the 9, 10 or 11, whichever it is, that is the Exide one.

THE COURT: Yes.

MR. MORRIS: I don't know whether it is 9, 10 or 11.

MR. WHITCOMB: Do you want to use these that are marked? That will help you, these have got the exhibit numbers on them.

THE COURT: Exide oxide is 5 and 6, isn't it?

THE WITNESS: Exhibit number 2 corresponds to number 6, yes. That is the mixed, that is the mill oxide.

THE COURT: That is what I thought.

THE WITNESS: Unfractionated.

By MR. MORRIS:

Q. But 10 is a finely divided, 10 is a finer fraction of finely divided number 6, isn't it?

A. That is right, that is the final, non-settling, super-centrifuge fraction.

Q. Now, the material that you analyzed as Exhibit number 10 was all extracted from or obtained from the Exide oxide?

A. That is right.

Q. Material taken by Dr. Wilson—

A. That is right.

Q. —from defendant's plant?

A. That is right.

By THE COURT:

Q. And that was the stuff that was produced here—

A. This morning.

Q. —in the test tube this morning?

A. Yes.

By MR. MORRIS:

Q. Now, are there lines on 9, 10 or 11—let's stick to 10, that are not found in number 6, on Plaintiffs' Exhibit number 21?

A. Yes, there are.

Q. Why?

A. A few very faint lines which we have been unable to identify. Two of three of them appear to be sulphate, probably. In other words, in the mill oxide

there is—there is present some impurity, possibly by reaction with SO_3 fumes, or something of that kind, in such small amounts that it does not appear in the original mixed substance, but appears only in this extreme fractionation.

THE COURT: Now, is there an extra copy of 21 that I could have? Dr. Wilson has mine. Has anybody got another one?

MR. MORRIS: I don't want mine.

THE COURT: All right, there is another one. Now, go ahead.

By MR. MORRIS:

Q. Are there any lines on 6 that do not appear on 10?

A. There are.

Q. Well, what are those lines?

A. Those are the lines which we have identified with metallic lead and with tetragonal PbO.

Q. All right, so—

By THE COURT:

Q. Those are the yellow and green lines?

A. Yes.

Q. On my chart.

A. Of course, it is perfectly true that two or three of the lines of Pb_2O fall very closely, in fact, practically coincide with the two or three of the lines of PbO, and, of course, that reservation must be made.

By MR. MORRIS:

Q. All right, what happened to the material of the product of your centrifuge, and how was it extracted, obtained from your centrifuge? I am speaking now

of the material which is number 10 on Plaintiffs' Exhibit 21.

A. As previously described, the material was suspended in—

Q. No, I want you to begin not with the original process, because that is in the record,—

A. Yes, all right.

Q. —but I want you to begin to take this material out of the machine after it has been subjected to the centrifugal force.

A. Then the low boiling oil in which the material is suspended is carefully evaporated at a low temperature, and the residue obtained, dried in vacuum, and, of course, preserved, stoppered up.

Q. What, stoppered up?

A. Stoppered up, yes.

Q. Stoppered up just like this here, Plaintiffs' Exhibit—

A. Well, originally it was, of course, sealed. That has been opened for X-ray and these chemical tests which I spoke of, so I brought it just as it was, one tube inside of the other.

Q. I thought you offered this this morning as Pb_2O. Did you or didn't you?

A. Yes, I did.

Q. Is it?

A. Well, it is Pb_2O with a small amount of impurity, yes.

Q. You kept that, it is now—

A. Well, it is fair to say that the sample has darkened since I have brought it from home, slightly darkened from what it originally was.

Q. Well,—

A. But I would be very glad to have, delighted to have your X-ray people make a pattern of that sample.

Q. You kept your sample prior to analysis as well protected from atmosphere as this one?

A. Yes, it was—

Q. Who was it requested that the sample taken by Dr. Wilson be forwarded to the respective parties or to you, particularly, with some sort of pentoxide?

A. I requested that.

Q. What was the purpose and object of that request?

A. It was simply to prevent any possible effect of moisture which might develop, keep the sample just as dry as possible.

Q. And there were tons of those samples, weren't there, that is, you could get a ton of that oxide from the E. S. B. Company, the defendant in this case, at any day you wanted, couldn't you?

A. Oh, I suppose you could.

Mr. Whitcomb: Oh, I don't know, we had plenty of trouble getting it.

By Mr. Morris:

Q. Well, you got those samples,—

A. Those few test tubes.

Q. —anyhow, and they are all in evidence, your exhibits, or plaintiffs' exhibits, of a great many test tubes full?

A. That is right.

Q. But it was necessary to preserve that with something that would prevent air or at least the moisture of the air getting into it?

A. Yes.

Q. And this rare stuff that you have been the first one to isolate, and where you produced possibly—how much, a half gram?

A. That is just, of course, the amount that remains.

Q. Yes.

A. That is left. Of course, we have used some.

Q. But how much is there in there?

A. Oh, I suppose maybe half to three-quarters of a gram, or—

Q. You mean—

A. Half to three-quarters of a gram, maybe a gram.

Q. All right.

A. I haven't weighed it. That has been, this tube has been kept always in a vacuum dessicator over P_2O_5 ever since it was formed.

Q. And the corks, these are the usual cork wood, aren't they?

A. Yes.

Q. Weren't they sufficient for excluding the moisture from the samples that were being forwarded to you?

A. Possibly would have been, yes, it just—that was just a precaution.

Q. But it wasn't necessary to use any such precaution with regard to this newly discovered or isolated Pb_2O, was it?

A. It has been preserved with the utmost precaution until I brought it with me the day before yesterday.

Q. I see, but now, then, the precatuions were relaxed?

A. Well, I don't—I don't think that it is—

Q. Is this the way you kept all the material—

THE COURT: Let him finish.

BY THE COURT:

Q. You don't think that it is what?

A. I don't think it is—I think I would be perfectly willing to submit it as—although, as I say, it has darkened a little bit—as the product as originally formed.

By Mr. Morris:

Q. Were or were you not being a little more exacting when you required our samples to be protected with pentoxide than you are with this sample, P 55, in the precautions which you have taken with regard to—

Mr. Morris: Pass that to the Bench, please.

A. Well, as I say, this sample has been guarded with even greater precautions from the moment of its formation until I brought it with me.

Q. But when it got into Court it didn't need to be?

A. Well, that is—

Q. All right.

A. That is protected.

Q. That is cotton in the bottom of that test tube that I am just showing you, isn't it?

A. Yes, yes, just prevent it from bumping.

Q. I don't want to go into this at any length, you may go into it as much as you like, but I am only asking this question to pick up a thread which we will follow for a moment. You spoke of a new X-ray camera, can I call it that with propriety?

A. Yes.

Q. You compared that with, spoke of it as being a great advance over the old X-ray cameras, as I recall it?

A. Yes.

Q. If I recall aright you also spoke of its requiring, the old cameras, ninety-six hours, or something like that, and this one required one hour?

A. Yes.

Q. When did you get that, Dr. Clark?

A. These—you mean this new camera?

Q. Yes.

A. Well, that has been—we have had a gradual de-

velopment, experimentally, that is, my students are continually working on better technique, making cameras themselves, and, as I said this morning, when we first began, about three or four years ago, getting into this lead problem, we had available only the General Electric equipment, molybdenum target. We utilized then the usual technique of sealing the material in a glass capillary and submitting it to the radiation. It took many hours to produce a pattern. It is no criticism of the apparatus, particularly, but we were able to then equip our laboratory with these very powerful copper target tubes. Of course, the previous cameras in the General Electric apparatus were no longer available, they couldn't be used for this purpose, and so we began the construction and design of the various types of cameras which you see on there.

The cylindrical camera was chosen, because we could surround the circumference or put a film clear around the circumference, and we could evacuate the camera, or put drying agents or inert gas, whatever it may be, in it, and we could submit, therefore, the specimen to the radiation in the form—on wedge shaped holders, so that there would be no passing of a beam through glass or other types of containers, and all the films which have been submitted have been made on this type of camera.

Q. My question was when you got it.

A. When we got it?

Q. Yes.

A. Well, the first one we had in 1933, and, of course, we have had several, we have several of them now.

Q. And the time of exposure, that is an hour, isn't it?

A. That is an hour. There are a few exceptions.

Q. Plaintiffs' Exhibit 31 is a picture of that instrument, isn't it?

(Plaintiffs' Exhibit 31 was shown to the witness.)

A. Yes, that is right.

By Mr. Morris:

Q. That is the outside, isn't it?

A. Yes.

Q. I refer you to Plaintiffs' Exhibit 60 for identification and ask you what that is.

(Plaintiff's Exhibit 60 was shown to the witness.)

By Mr. Morris:

Q. And I read that, that that was exposed for three hours?

A. Yes.

Q. Am I right?

A. That is right.

Q. And what is it?

A. This is the aged Exide oxide which had been exposed to air. This one was taken with—for three hours because our tube had become quite—as it gets older, becomes weak, and with also the special purpose of bringing out by long exposure, if possible, weak lines which might be there.

Q. If Ferrari didn't have Pb_2O, did you?

A. I have a—I have, and I am firmly convinced, I have Pb_2O, especially from the fact that we have been able to concentrate this material with a cubic structure, a very logical cubic structure, by this fractionation method.

Q. If—

A. It is, I think, incidental that our results are independent results, entirely independent, may or may not have confirmed what he—what he had previously found.

Q. And in your results I remember you used the word "harmony", the other day. Your results are in perfect harmony with the results of Mr. Ferrari, aren't they?

A. They are in harmony in the sense that with both they found a face centered cubic structure. His value for the constant was 5.38; mine is 5.33, which is—

Q. Oh, you mean, you mean that Mr. Ferrari found the constant a sub zero to be 5.38 Angstrom units, and—

THE COURT: Somebody will have to explain this to me, I am sure of that, either now or later.

MR. MORRIS: I will get to the sub zero in just a moment.

By MR. MORRIS:

Q. —and that you found that the Pb_2O structure had shrunk down to 5.33 Angstrom units?

A. Well, I think that is—that is our constant value: I think that difference is without significance, it is simply the difference in technique.

Q. Technique?

A. Or accuracy of measurement.

Q. Well, I know, but you gave me a document here that is of the highest accuracy, didn't you, Dr. Clark?

A. Well, it is the highest accuracy from our date, yes.

Q. Well, but, you know, you puzzle me. Do the lines for the face centered cubic type of pattern for lead—do you get perhaps the same lines for lead that Ferrari did, the metal lead?

A. Yes, the check is very close.

Q. Now, as close as 5.38 to 5.33—

A. Yes.

Q. —Angstrom units?

A. Yes.

Q. And, Dr. Clark, any closer?

A. Yes, slightly closer, the reason being, of course, that we are dealing with this, in this suboxide, with broad lines, and, of course, in previous, in all the previous films with rather faint ones.

Q. Yes.

A. It is simply a matter of measurement, that is all it is.

Q. Well, that is all, that is all the X-ray test is, anyhow, isn't it, a matter of measurement?

A. Yes.

Q. All right.

A. Measurement to the best of one's ability.

Q. But with the 5.33 Angstrom unit a sub zero line, by making that fundamental change you are able to reproduce Ferrari, is that your thought?

A. Yes, yes, it is a cuprite—

Q. How far would you have been at liberty to make a fundamental change and not reach Ferrari, to coincide with Ferrari?

A. Well, it amounts only to fractions, fractions of millimeters, as far as that is concerned. It would—I would put plus or minus upon my results, 5.33 plus or minus 04, probably.

Q. Well, you would have to get 05 to reach Ferrari, though, wouldn't you?

A. Yes, but we have no—I would want to see Ferrari's films before I would be able to see how accurate his were.

Q. You are able to explain in any film that you get, aren't you, each line that you get on that film?

A. Well, that is what we always try to do.

Q. All right.

A. But it isn't always possible.

Q. Will you explain this P-48, introduced this morning?

THE COURT: P-48?

MR. MORRIS: P-48, Pb at the top.

MR. WHITCOMB: Exhibit 48.

THE COURT: Yes, I will have it in a minute.

MR. MORRIS: P-48, of the plaintiffs. Angstrom units a sub zero, do you want that now?

THE COURT: Oh, no, I guess it would only make things worse.

MR. MORRIS: I think it will not, I think it will not, if your Honor please.

By MR. MORRIS:

Q. Will you tell me what the Angstrom unit is? If I understand it, I want a lesson at the same time, it is a unit of measurement of the X-ray, is it not, length measurement?

A. Wave length, yes.

Q. Wave length?

A. It is one-one hundredth thousandth of a centimeter; ten to the minus eighth power centimeters equals one Angstrom unit.

THE COURT: Well, all right, I understand what that is. I don't know what the a sub zero—

By MR. MORRIS:

Q. Now, can you tell me briefly what the a sub zero line is, in crystallography?

A. Could we have that picture of those lattice models?

THE COURT: Yes.

MR. MORRIS: Yes.

THE WITNESS: I think that would show.

By MR. WHITCOMB:

Q. Will you hold it so the Court can see it?

A. Yes. If we subdivide a crystal, that is, the result of X-ray analysis, subdivide it down just as far as we can get on the basis of this analysis we finally come to a little cell, the last thing, it is still a crystal, and that cell simply represents distribution of atoms or molecules in space, so the fundamental dimensions of that little unit cell, which, after all, is the measurement of distance between planes of atoms, is what we call the lattice constant, or a sub zero value.

By THE COURT:

Q. Does that cell repeat itself through all that?

A. Repeat—here is lead, right here (indicating).

Q. Yes.

A. In a big chunk of lead. There is another one here, here, here, all around, different directions (indicating).

Q. Yes.

A. Until you have the crystal you can see.

By MR. MORRIS:

Q. It is the fundamental measurement of crystallography?

A. Yes, that is right.

By THE COURT:

Q. What is the a sub zero part?

A. The a sub zero is the size, say particularly in a cubic crystal, is the size of that little unit cell.

By MR. MORRIS:

Q. Is the edge line, in other words, isn't it?

A. Yes, it distinguishes one substance from another, because it is a measurement of the distance between planes, or the architectural plan, whatever that may be.

By Mr. Whitcomb:

Q. Can you point it out on there to the Judge?

A. Yes, this one of lead here, you see, the a sub zero value for lead would be this string right along there (indicating).

The Court: I see.

By Mr. Morris:

Q. That is 4.92?

A. 4.92.

Q. 4.92 Angstrom units?

The Court: That is all right, I believe I understand that.

By Mr. Morris:

Q. And Ferrari found 5.38 for his so-called Pb_2O?

A. Yes, I think, if I remember right, that is right.

By the Court:

Q. You found what?

A. 5.33 was the average of our results.

By Mr. Morris:

Q. 5.33?

By The Court:

Q. He found 5 point what?

A. 38.

Q. Yes.

By Mr. Morris:

Q. Let's pass back now just for a moment to Plaintiffs' Exhibit 60, which is the film of aged Exide powder, gray oxide, which had been exposed to air. Am I right?

A. That is right.

Q. Will you point out there to us the Pb_2O lines, so-called, on that?

A. No Pb_2O lines there, that I can see.

Q. None on that? Why not?

A. Disappeared.

Q. You mean what disappeared?

A. That is the evidence, the evidence which we submitted before, in these "D" samples of five or six or seven per cent of lead suboxide, there are no lines in this pattern which correspond to that at all, all of which means that the Pb_2O initially present and on exposure to air on a watch glass, just simply standing out on a watch glass, completely disappears.

Q. Oh.

A. At least, goes below one per cent or so.

Q. Now, if I understand you aright, the material of which you took the film represented by Plaintiffs' Exhibit 60 was exposed to the air at room temperature for some time?

A. Yes.

Q. For how long?

A. Well, that was, I think, just overnight, just in a watch glass, in a watch glass.

Q. Mr. Shimadzu says in his patent 150 that suboxide is almost but not quite as reactive as lead powder, his suboxide is almost but not quite as reactive as lead powder. I assume he means finely divided lead powder. Do you agree with Mr. Shimadzu on that?

A. The activity of the Shimadzu oxide taken out

of the mill is due very largely to the finely divided metallic lead.

Q. The activity or reactivity of lead powder, did you say, is due to the finely divided metallic lead?

A. Metallic lead.

Q. Of what lead powder?

A. Well, of any, any mixture where you have very, very finely divided metallic lead.

Q. Then you found Pb_2O is not as reactive as finely divided lead powder?

A. No, I don't believe it is, this fraction which we have out surprised us by being actually more stable than we thought it might be.

Q. Well, does that—

A. It can be maintained in vacuum, or it can be maintained in oxygen-free water, under oxygen-free water.

Q. Yes, but it was so unstable that it disappeared at room temperature overnight?

A. Yes.

Q. Have you figured out the number of hours that the lead dust is in the Hall mill in the Exide plant?

A. Well, I don't know, of course, I have no idea how long that is. The supposition is that the powder is removed fairly rapidly from the—

Q. Now, let me see if I understand what you mean by that, fairly rapidly, you mean perhaps what?

A. Well it is—it is conceivable, it seems to me, that while you can't measure any such thing as that, it is conceivable that some powder abraded off of the balls would be instantly removed from the mill, and, of course, collected. The suboxide, of course, can be protected for some period of time, especially, it might be surrounded by metallic lead, something of that kind.

Q. Well, now, the temperature has been shown at which the Hall mill operates as 340 to 345 Fahrenheit,

that is, with a thermometer in the position in which it has been shown that it is.

A. Yes.

Q. If suboxide vanishes and disappears overnight at room temperature do you think it is so stable that if it were in the Hardinge mill for a few hours or several hours at three hundred and forty or forty-five degrees Fahrenheit that it is not sufficiently reactive as to disappear?

A. Well, there is no question but what a large amount of lead suboxide must disappear in the Hall process. Of course, I must say this, that this sample is a year old, to begin with, and it was simply spread out on a glass very—in just almost a single grain layer.

By the Court:

Q. Which sample, please?

A. This sample we are speaking of, this film here.

Mr. Morris: P-60.

The Court: All right.

The Witness: Simply exposed in a very thin layer to moist air, and the pattern made on September 12th, or whenever it was.

By Mr. Morris:

Q. Well, but we went into the question of how you kept your samples a while ago, didn't we, and we found until you brought them into court they were kept very carefully?

A. Yes, that is true, that is true. The Exide samples have been kept over P_2O_5 all the time.

Q. So you would not have expected any change so long as it had been so carefully guarded as that?

A. No, not very much, at any rate.

Q. So you and I would agree, wouldn't we, that if

there had been any change in the chemical composition of the product which you left out overnight, that it occurred while it was so left out overnight?

A. Oh, substantially the largest amount, yes.

Q. Now, let's go inside of the Hardinge mill just for a moment, again. You attribute the fineness of the lead to the chemical reaction inside the mill, don't you?

A. I do.

Q. And that is due to the sliding off of one molecule of lead from the alleged Pb_2O, isn't it?

A. Yes, the dissociation of Pb_2O, which in its ultimate sense is an actual molecular process.

Q. Well, in my layman's, crude layman's way of looking at it, I happen to have two quarters and a nickel, they are combined to form a molecule, let's look at the quarters as Pb and the nickel as O. Now, if I take away one of those quarters, namely, one atom of lead, I have got PbO, haven't I?

A. That is right.

Q. Is that what you mean, does that illustrate the reaction?

A. That is all right.

Q. What becomes of the atom of lead?

A. That atom of lead may then undergo oxidation, or it may anneal itself, it may grow into crystalline lead.

Q. Do you think that in this mill as you have examined the process there is any dearth of oxygen at any time?

A. There is a dearth of oxygen down in—in the inner surface of the balls.

Q. Is there in the Shimadzu process?

A. Under any oxidized outer layer which has not yet been removed there must be a deficiency.

Q. I am speaking of the atom of lead that has been split off from the two atoms and left PbO and a free

atom of lead, now, you mean that the only Pb_2O that you can contemplate or conceive of in the Hall process is shielded from the oxygen by an outer layer on the balls?

A. Not at all. Pb_2O has a temperature coefficient of dissociation which requires time.

Q. Pb_2O has what?

A. That is, it has a—it undergoes dissociation over a period of time. If more space—

Q. I thought it was rather fugitive.

A. Yes, it is rather fugitive, but even so there is a finite time for—

Q. Of how many hours?

A. Well, there is no way of knowing, that is all, all we can—

Q. You puzzle me, Dr. Clark, and I tell you where my trouble lies. A while ago I thought we understood each other very clearly, that finely divided metallic lead was very reactive, and, indeed, if I remember your testimony of some days ago it is pyrophoric to a high degree. Now, then, we have gotten down to atomic size of metallic powdered lead, and I am wondering when you reduced it to that size, and with a superabundance of oxygen, save as that lead, the oxygen cannot reach that atom of lead, when it is protected by the outside coating of the ball. I am wondering why that atom of lead, which is highly reactive at room temperature, is not equally highly reactive at a temperature of three hundred and forty or three hundred and forty-five degrees.

A. It is, there is no question about it.

Q. Well, then, would atomic lead be more reactive than a particle of lead a half a micron in diameter?

A. As a solid, why, it would, because its normal valences, of course, would not be satisfied.

Q. Are you indicating that lead is in a gaseous form or liquid form in the Hardinge mill?

A. No, I don't postulate that, it is simply there as a dissociated solid.

Q. Now, there are several other things I want to ask, but I am still puzzled, and I don't mind telling you so, as to the reaction you conceive of, which it seemed to me to reduce that free lead to atomic size, and it is highly pyrophoric, even when it is much larger than an atom, now, then, I cannot conceive of how those free atoms of Pb can get out of that temperature when they are in it for a long time, when that temperature is three hundred and forty to three hundred and forty-five. Will you try to make it clear to me, because I don't get it?

A. Yes, well, the thing as I picture it is this, the basis for the consideration, of course, is the presence in materials of this kind of exceedingly finely divided phases even of metallic lead, far beyond, so far as we know, the ability of any grinding process, nobody has, so far as I know, has ever succeeded in grinding metallic lead.

Q. Does the reaction have to be the PbO_2 reaction in order to account for its fineness?

A. It seems to me the perfectly logical thing, in the light of the eight reactions which I tried to outline the other day, that the first entrance of—we will postulate, first of all, before any abrasion can take place, before a product can be formed, some kind of oxidation must take place, we have an absorbed air film, oxygen; the next thing—which is governed by all of the physical laws of the environment—the next thing we can postulate is the oxygen entering, that is the only way it can, is to enter in and combine with, in some way, the lead, and the process, as we have postulated it, is that metallic lead is able in the normal

state of affairs to take up into itself, into its lattice, a limited amount of oxygen, forming—still retaining a cubic type of structure.

Then, of course, as further oxygen is added, or as the—as the material remains a long time at high temperatures, or something of that kind, other oxygens may be added, and the whole structure rearrange itself, over a finite time interval, it may be very, very short, into a stable, more stable configuration of lead, one, oxygen, one, under other—remembering that all these eight things are going on at one time, that such a latticework, in case it may be in a position for the moment with a deficiency of oxygen, relatively speaking, may prefer from the standpoint of its free energy, or something of that kind, to separate itself into lead and PbO, thus forming, as we know, in a large crystal, which would disintegrate, which would have to go through a type of molecular process, into lead and PbO. Then, as I say, this metallic lead, formed by the dissociation, as I say, of lead suboxide, can either go right on up in the oxidation process, in which there must be this lattice rearrangement, or lead suboxide formed as the first stage in which oxygen is first taken on, may break itself up into a more stable lead lattice and a more stable PbO lattice.

This lead then being regenerated, for the purposes of—which may then oxidize, or, under certain conditions that we know, well known in the field of metallurgy, lead atoms may actually be enough of them to get together to form a crystal of lead, and that that crystal may actually grow into a little pellet, a little ball, thereby becoming inactive and no longer entering into the equilibrium at all. If we could keep metallic, atomic metallic lead and molecular PbO there, then the possibility would be to make them combine and recombine to form Pb_3O_4, if we had the proper energy

conditions, or we might reach equilibrium where there would be a much higher proportion of Pb_2O than there is in the product, but the equilibrium, if such equilibrium does exist, is being—a tendency all the time is for the dissociation of Pb_2O into lead and PbO, because the lead, that finely divided lead can oxidize and be removed from the equilibrium, or it can crystallize and grow, being no longer active enough to enter into this equilibrium.

By THE COURT:

Q. Would you mind defining equilibrium as you are—

A. Well, it is this equation with two arrows, Pb_2O, arrows, Pb, plus PbO.

Q. What does that mean?

A. If we could keep all those three solids, right there, without change, then at a given temperature, as we know in chemistry, for all reactions and dissociations, there would be a place where certainly the rate of dissociation of lead suboxide into lead plus PbO would exactly equal the rate of combination of lead and PbO to form Pb_2O. That is what we call a condition of equilibrium.

By MR. MORRIS:

Q. That could occur in solid phase?

A. If those materials were kept in essentially molecular dimensions, only.

Q. Then, in short, if I understand you, your conclusion is this, that a material that had survived as Pb_2O in the Hardinge mill, possibly for many hours, at a temperature of three hundred and forty to three hundred and forty-five degrees centigrade, would disappear at room temperature if exposed to the air overnight?

THE COURT: Pardon me, you said centigrade; do you mean Fahrenheit?

MR. MORRIS: Fahrenheit, yes, sir, that is three hundred and forty to three hundred and forty-five Fahrenheit, thank you.

A. Only provided that the powder were in a very thin layer, and in moist air. We know, of course, we have done experiments in a vacuum desiccator, and things of that kind, in which we find it very stable. Pb_2O, and also metallic lead, it must be said, is most sensitive to oxidation when in the presence of moisture, although the oxygen and the moist surface must come in contact.

Q. All right, let's pass that.

A. All right.

Q. Could you give me a theory equally as sound for the fineness of the lead if you assume no Pb_2O reaction in the Hardinge mill, and assume only a PbO reaction?

A. Well, of course, you have no—

Q. I am asking you as a scientist, now.

A. Yes, I know, I am trying to answer the best I can, I am more or less thinking aloud. We have no reducing atmosphere, of course. We know that we can produce exceedingly finely divided lead by reducing an oxide with hydrogen, or under suitable method, but no such condition here applies. We might think of the reduction of PbO by metallic lead—

Q. Now, let's have no Pb_2O reaction in that mill, now, let's get it out and not have it, and I think my question was whether you could think of any hypothesis upon which you could account for the existence of lead in as finely divided form if a chemical reaction within the mill is assumed to be PbO instead of Pb_2O.

MR. WHITCOMB: I think he ought to go ahead with his answer, your Honor.

THE COURT: Well, he is going to be allowed to.

MR. WHITCOMB: He was interrupted.

THE COURT: No, he wasn't interrupted, he finished his answer and then Judge Morris repeated his question.

MR. WHITCOMB: Would you mind repeating—

THE COURT: He wasn't satisfied with his answer.

MR. WHITCOMB: Would you mind asking the witness if he was through?

BY THE COURT:

Q. Were you through?

A. Well, I was just—it is perfectly all right, I just wanted to get clear what Judge Morris—

THE COURT: Read that last question of Judge Morris's again, Mr. Rodebaugh. You can start all over again, if you want to.

MR. MORRIS: Yes.

BY MR. MORRIS:

Q. My question presupposes the non-existence of the Pb_2O or any molecule of it in the Hardinge mill at any moment, and I am presupposing that the chemical reaction that takes place in the Hardinge mill is PbO reaction, and I am asking you as a scientist whether on that assumption and hypothesis you can account for the presence of lead, the product as finely divided as the product that you have in your samples from the Hardinge mill.

A. Under such a hypothesis I think it is entirely conceivable that when a lead oxide is abraded off it

might tear bits of lead, which is, of course, the lead is undoubtedly dendritic, and may be brittle—not brittle, no, but perhaps crystalline, in the sense that it might—might break off pieces of lead from the underlying ball, and even under my hypothesis or my theory I also—I also would include that distinctly as a possible formation of some lead.

By THE COURT:

Q. Well, now, let's see, does that answer the question "yes", then?

A. No, I haven't finished—

Q. All right.

A. —yet. I don't believe, now, this is as far as I can go, because I don't suppose anyone can know, I don't believe from my own experiments that it is possible to tear off metallic lead or to grind it off and get it as fine as can be actually produced or as is actually present in many of these products.

By MR. MORRIS:

Q. Products of the Hardinge mill, now, I am not speaking about the Shimadzu products now, I am talking about the product of the Hardinge mill, the gray oxide.

THE COURT: That is the Exide oxide.

THE WITNESS: Yes.

THE COURT: The Exide oxide.

MR. MORRIS: Yes, sir.

THE COURT: What we have called—

MR. MORRIS: The product of the Hardinge mill, the gray oxide, the Exide product.

THE COURT: Yes.

MR. MORRIS: The Electric Storage Battery Product.

THE COURT: What was that question?

THE WITNESS: Well, it is perfectly—I am very frank to say this, that there is a fairly good particle size of lead in the Exide sample, that is, the lead lines are dotted, as the X-ray patterns may show. Now—

By MR. MORRIS:

Q. Well, now, just pardon me for a moment, because I think Judge Kirkpatrick might like to see that. No, I am wrong, I thought for a moment that my recollection was that the dots on 10 and 11 were such dots, but I am wrong about that, and I find one of those illustrations here. Will you proceed?

A. Let's see,—

Q. In 10 and 11 dots were intended to mark your so-called Pb_2O lines.

A. —in number 5, Judge Morris, you will see what I mean by dotted lines.

Q. I know.

A. They are the second and third—

Q. I know what you mean, but just for the moment I got confused in my mind.

A. Now, there is no way of knowing whether that lead has grown by an annealing process or whether it has been torn off in that size.

Q. Well, I wonder if you could give me an answer "yes" or "no" to my question with respect to the Exide product, the gray oxide.

A. I am afraid I don't know.

Q. You don't know whether the product of that fineness could be accounted for on the assumption that the only chemical reaction in the mill is the PbO reaction, or not?

A. The only data, of course, which I have are the X-ray patterns, and upon the basis of that I couldn't say.

Q. On which—

A. I couldn't say—

Q. I see.

A. —as to the lead particle size.

Q. I see.

MR. MORRIS: Will your Honor be good enough to turn to Plaintiffs' Exhibit 48, which we started in some time ago, but haven't gotten to it?

By MR. MORRIS:

Q. You have, too, haven't you, P-48? Where did you get your Pb that is used in that exhibit, please, Dr. Clark?

A. This was a—this particular sample of metallic lead was obtained from our chemical storeroom.

Q. Do you know anything about its purity?

A. This, if I remember rightly, was—

Q. Will you suspend just a moment?

A. I beg your pardon.

(Interruption.)

By MR. MORRIS:

Q. Now, you got your lead from the storeroom or whatever you call it in the University of Illinois?

A. Yes.

Q. Do you know anything about its purity?

A. Well, if I remember right it was the Eimer and Amend's spectroscopically pure lead.

Q. You used your usual care and skill and precaution in getting that lead in its pure form into the camera?

A. Yes, it was—it was very hard to handle, got to be handled—

Q. Yes, but you did?

A. Yes.

Q. You handled it?

A. Exactly.

Q. All right, so that when you got it in that capillary tube in the camera it was still pure Pb, wasn't it?

A. As far as I know.

MR. MORRIS: Now, I wonder if you will be good enough to let us have that easel with the paper on it, please?

By MR. MORRIS:

Q. Will you tell me what those lines are that are not checked on this?

A. Some of those are beta lines, very probably, and there may be three or four lines there due to very slight amount of impurity.

Q. But, frankly, my trouble is this, Dr. Clark, the lead lines are checked, aren't they?

A. Yes.

Q. And all the lead lines are checked?

By THE COURT:

Q. Well, would you mind telling me the mechanics of this thing? What is it? What do these columns of figures mean?

A. That is simply a numerical measurement on a film.

Q. You start here where it says "line"?

A. Line.

Q. Those are the different lines?

A. Yes.

Q. That is the first line you made, from the left, is that right?

A. That is right, from the left.

Q. And you found it was 3.5 millimeters from where?

A. From the so-called zero position.

Q. All right.

A. On the film.

Q. Zero position. Then there is a theta here. What does that mean, that column?

A. That is the angle, the angle of that line, that is the measure; here is the main beam of X-ray that goes right on through, and here is the diffracted beam, and that is the angle between.

Q. Well, it has something to do with the curve of the line? Or has it?

A. Well, it is the angular distribution of the line. We have a linear measurement, which is in column two, and in column three we refer it back, you see, to this angle between the diffracted beam, that is, the beam that is bent, and the beam that passes right straight on through.

Q. And then the next thing?

A. Then we have the sin of half of that angle.

Q. That is another check on the angle?

A. Well, we divide the angle by two and take the sin of that.

Then the "d", the value of "d" is calculated from the familiar equation, n times lambda equals 2d times sin of theta. "d" is the distance, and lambda is the wave length of the X-ray beam.

Q. All right, "indices"?

A. Indices are the particular kinds of planes, the planes to which the given set of spacing belongs.

Q. That is a conclusion, that last, the last column is a conclusion?

A. Yes.

Q. From the other data?

A. That is the direction. You see, as you look at

this lattice here in various directions, like this (indicating), you have all sorts of parallel planes through it.

Q. Yes, but those indices, you don't measure that—

A. No.

Q. —from anything on the picture?

A. No, that is a calculation.

Q. That is arrived at by calculation?

A. Yes.

THE COURT: All right, well, I have an idea about it.

By MR. MORRIS:

Q. If you could get this many additional lines that you cannot account for when you are using, taking the X-ray diffraction pattern for pure lead—question withdrawn—maybe you can find for me some cuprite structures in those additional lines there. Can you?

A. No, I don't think so. Most of these lines, of course, can be—if not all, I don't just remember, but I think most of them, if not every single one, can be accounted for as beta lines, but not a filtered beam, on those big charts which you have, this same type of analysis, that is, those large mathematical charts, same type of analysis is made, in which the—no, these charts, like these (indicating).

By MR. WHITCOMB:

Q. What exhibit is that?

A. 59.

Q. 59?

A. D-2 will show that better, I think.

By MR. MORRIS:

Q. So it is unnecessary to assume the presence of any Pb_2O to account for any of those lines; is it?

A. You mean in this spectrum?

Q. That is right.

A. The most important lines are—

Q. Lead lines—

A. —completely missing.

Q. Lead lines, lead lines, aren't they?

A. Pb_2O, yes.

Q. No, I am afraid we are talking at cross purposes, Dr. Clark. The most important lines in that are the Pb lines, or the Pb_2O lines, or—

A. Pb lines, but I say missing completely from this table are the important Pb_2O lines.

Q. I see. Dr. Clark, you have given in your work sheets or in your log, and you haven't given any other place any tested explanation for those lines other than lead lines, which you found in your diffraction pattern for lead, have you? I mean, the only explanation you have given for those lines to me at all is what you have given orally just now, no explanation appears in any of these sheets, work sheets, that you have given to me?

A. Well, I am not sure I know just what you mean, except in—

Q. Now, let me see if I cannot make it clear.,

A. Yes.

Q. You gave me the work sheets which have been introduced in evidence.

A. Yes.

Q. Those are all you gave me. Then I would be unable to find anywhere in there any explanation or experimental demonstration of what those lines other than the lead lines are on Plaintiffs' Exhibit 48, for lead, pure lead.

By the Court:

Q. Well, now, are there any lines on 48 which are not lead lines?

A. Those, the ones that are checked, of course, are calculated, they are all calculated with a single wave length, and the ones that are checked are the known indices, the known planes, known values.

Q. Oh.

A. For metallic lead, but this beam, as I say, contained another component, which would give another faint line.

Q. Well, now, look at this chart, which is really simply a simplification of one of the photographs.

A. That is right.

Q. I looked at the lead strip. There are, as I figure it out, about twenty-three lines there?

A. That is right.

Q. There are twenty-three lines here in your Exhibit 48?

A. Well,—

Q. Now, does that mean that this yellow chart, which is also number 2 on Exhibit 21, that that is what your supposedly pure lead gave you, of which only eleven lines have been identified as lead lines?

A. Those are the first eleven lines on this—of course, this pattern was only taken to about .8 Angstrom units. The first—yes, first eleven lines on that pattern are these which have been indexed on the side.

Q. Have they been checked, you mean?

A. Yes.

Q. Yes, so a lot of these yellow lines that you marked yellow on this chart are not lead lines, as far as is known?

A. Yes, those are lead lines consistent with, let us say, P-56, Plaintiffs' Exhibit number 56, where lead was used to calibrate the camera.

By Mr. Morris:

Q. Well, if these are beta lines instead of alpha lines for—withdrawn.

If the lines on Plaintiffs' Exhibit 48 unchecked are the beta lines for lead instead of alpha lines for lead that could be quickly ascertained—

A. Yes.

Q. —and determined, couldn't it?

A. Exactly.

Q. You weren't using any screen, then, in this instrument?

A. That is right.

Q. It was the cylindrical form of chamber?

A. Yes.

Q. With a single aperture?

A. Yes.

Q. Circular in dimension, round?

A. Yes.

Q. Of what, forty millimeters?

A. You mean the pinhole size?

Q. Yes.

A. About forty thousandths of an inch.

Q. Is that forty millimeters, or not?

A. No, forty millimeters would be four centimeters.

Q. No.

A. This is very, very tiny—

Q. All right.

A. —size.

Q. Dr. Clark, in Plaintiffs' Exhibit 59, which has all these figures, and begins "Complete Tabulations for C83 Film. Camera constant 1° gives 1.215 mm.," —what, I can't read the next, what is it?

A. Colog.

Q. Oh, yes, colog, equals 1.91542. What did you use for that experiment?

A. That was a sample prepared from lead oxalate.

Q. I think you told me that in your lead oxalate

you used—tests—you used a three hundred and ten degree constant temperature. Was this one made that way?

A. I could tell you exactly—C83 was lead oxalate, was a sample of lead oxalate prepared at 330 degrees in vacuum, heating for two hours.

Q. 330 degrees in a vacuum, heating for two hours?

A. Yes.

Q. Well, now, what does this exhibit purport to show, Dr. Clark?

A. This is a complete analysis of all the lines which appeared on that film, and with the distribution of lines or the identification of lines definitely between lead, red PbO, and at least five lines which stand out by themselves for Pb_3O_4. The purpose of this—

Q. Can you give me those five lines?

A. I beg your pardon?

Q. Those five lines are what number?

A. The ones designated out there on the very edge by X's.

Q. You mean under "Pb"; the column after "d"—oh, no, no, the last column?

A. Yes, that is right.

Q. I am sorry, Doctor. Will you proceed, please, can you give me the numbers of those? Are they 4, 6, 23 and 24?

A. Yes.

Q. Yes.

A. The strong line of Pb_3O_4, which is very characteristic of it, is the one, the 2.609 standing out.

Q. Is the one what, please, Dr. Clark?

A. With the "d" value of 2.609. These are simply all—as you can see, every single line is there, under the two columns, log. sin of theta.

Q. Yes.

A. And log, sin of theta, plus a constant.

Q. Yes.

A. Is the provision made for identifying any line which might be the beta line, the one beta line of the other.

Q. Dr. Clark, will you tell me why you used 330 degrees in a vacuum?

A. This just happened to be one of the whole series of experiments in which the temperature was varied, the time, and various conditions.

Q. Well, I see. Would you have any different results had you used a temperature of 310?

A. At 310, which is the sample C119, for which we have microphotometer curves, we obtained stronger, that is, more intense PbO lines than we did at 330, or at any other temperature, but there was some there even at this temperature.

Q. Well, now, when you tell me that you operated that other sample at 310 degrees, you mean within variations to what extent?

A. Well, the decomposition of lead oxalate, that is, at least, in so far as its reproducibility of the product is concerned, is exceedingly sensitive, and certainly the temperature in order to reproduce a sample made, let us say, at 310 degrees, in which we have a thermometer, good thermometer present in the tube, must be within at least one degree of 310, to reproduce a product with the same distribution in it.

Q. Well, now, have you your thermometer sheet? I suppose you use a recording thermometer when you are making a test that is so exacting as that one, don't you?

A. No, just a regular, just a—

Q. You don't?

A. —ordinary thermometer.

Q. Human reading, and not mechanical recording?

A. Yes.

Q. Well, then, of course, where it is so exact, I assume that you make a memorandum each minute, or each minute and a half of the temperature readings, don't you?

A. They are—the temperature is kept, I mean, the temperature is watched very carefully.

Q. Well, now, which do you mean, watched, or kept, Dr. Clark?

A. Well, I mean it is simply watched and the temperature kept right at the—by varying the current, say, through the electric furnace.

Q. That is, if the temperature tends to run up you would reduce the current?

A. Yes.

Q. And if it tends to run down you would increase the current?

A. Yes.

Q. And thereby you can hold the temperature at the 310 degree temperature within a variation of one degree?

A. It can be done, yes.

Q. No, but was it done?

A. It was, yes.

Q. Now, what kind of heat did you have, a power line?

A. Yes, yes, power.

Q. A. C., or D. C.

A. A. C.

Q. Do you know the normal voltage?

A. One hundred—averaged about—it is ordinarily about one hundred and fifteen volts, I think.

Q. Well, of course, you were running a scientific laboratory there, you know the voltage that you used, didn't you, and you know now the voltage that you did use, don't you?

A. Well, I wouldn't say that I knew it exactly, no.

Q. Well, are there ever any voltage variations on that line?

A. The voltage was not—the constancy was the temperature—

Q. It is not constant?

A. Temperature was maintained.

Q. But what I am trying to get at is as to whether the voltage is constant, and no variations.

A. It is very constant, yes, I mean—

Q. It is?

A. —under normal conditions.

Q. Well, now, isn't it necessary for you to know the voltage variations in order to aid you in holding your temperature constant?

A. Well, there was no—no purpose in doing that so long as the thermometer was right there in full sight, which could be—and the temperature kept as nearly as possible at 310 degrees.

Q. You mean the human control over temperature on a line having voltage variations is so exact that you may maintain a temperature of 310 degrees within one degree? That is 310 centigrade or Fahrenheit?

A. That is centigrade.

Q. Yes.

A. Well, I would say that, to be perfectly sure, that, at least, it was within certainly two degrees in this experiment.

Q. Well, now, Doctor,—

A. As a maximum.

Q. Now, Doctor, please, won't you have my question read to you?

MR. MORRIS: Will you read it, Mr. Rodebaugh?

(The question was repeated by the Reporter, as follows:

"Q. You mean the human control over temperature on a line having voltage variations is so exact that you may maintain a temperature of 310 degrees within one degree? That is 310 centigrade or Fahrenheit?")

MR. MORRIS: I think it is my mistake, I am sorry.

By MR. MORRIS:

Q. Well, did you or didn't you have any device in your line to insure constancy of current?

A. There was not.

Q. You had no record of your experiment, you have no record of the temperature of your experiment, have you? I am not speaking of memory, I am speaking of written documents.

A. Well, I have, I have a—yes, I have a memorandum of the actual—

Q. May I have it? I thought I had all that you had, Dr. Clark.

A. No, I didn't know that you would want that.

Q. Oh, yes, I do. Now, the 310 degree sample was what number?

(The witness indicated the experiment.)

By MR. MORRIS:

Q. All that memorandum says of temperature is 310. It covered a time of how much? How much time did the experiment require?

A. That was two hours, too, I think.

Q. Did you do that personally?

A. This was done by Mr. Wood.

Q. Well, would you just assume, Dr. Clark, in a question of this magnitude, involving the discovery in 1935 of a new compound somebody else would make an experiment which required an exact temperature

within one degree where they kept no detailed record of the temperature?

A. We were interested in these experiments from a purely experimental point of view, to get an idea of the approximate temperature or the approximate conditions in which a sample could be prepared with lead suboxide present, or with a maximum amount of lead suboxide. There was no intention at any time of going to such extremes in the way of experiment or anything of that sort, it was just a preparation of samples, that is all.

Q. Now, did you use the phrase "approximate temperature" in this last answer? I thought you did.

Mr. Whitcomb: Read the answer.

Mr. Morris: Will you read the answer?

(The testimony was repeated by the Reporter, as follows:

"A. We were interested in these experiments from a purely experimental point of view, to get an idea of the approximate temperature or the approximate conditions—")

By Mr. Morris:

Q. Approximate, all right. Then you don't know as a fact that that temperature did not vary two, three, four, five degrees, do you?

A. Well, I know that—I know that Mr. Wood did maintain the temperature, the operator was continuously present during the experiment and operated and watched the temperature continuously with great care.

Q. Well, if the departure from 310 had been even as high as three degrees it would not have made any particular difference in this experiment, or not?

A. Not, no, it would not.

Q. All right. Now, what kind of a thermometer did you use to measure your temperature?

A. It was a mercury, mercury thermometer.

Q. Well, do you know what your technique was for finding out when to adjust the voltage control on your furnace, or Dr. Wood's technique?

A. He had, of course, he had a resistance in series, and by watching temperature, simply, simply—

Q. All right.

A. —kept the temperature as constant as possible.

Q. Do you know whether there would be any drift in the temperature after changing the controls?

A. I don't know as to that, I didn't see that.

Q. So the only entry we have with respect to temperature is 310?

A. That is right.

Q. Now, there is another phase that I want to take up now, if you don't mind.

Mr. Whitcomb: How about a recess?

The Court: What did you say?

Mr. Whitcomb: Could we have a little recess?

The Court: Surely, all right; ten minutes.

(Recess at 3.15 o'clock P. M.)

After Recess.

Re-cross-examination (Continued).

By Mr. Morris:

Q. If my information is correct, the books in the English language that give substantially accurate

statements as to proper techniques to be used in taking and interpreting X-ray "powder-method" diffraction patterns are, "The Crystalline State" by W. H. and W. L. Bragg—

By THE COURT:

Q. Before you leave this matter, we were talking about such a control of temperature and voltage and that sort of thing, that has to do solely with the experiments on the oxalate?

A. Yes.

Q. The experiments you made on the product of the plant do not require any furnace or any heating?

A. Nothing whatever.

Q. Or any control or anything?

A. That simply—

Q. I was going to ask the question why did you make oxalate experiments at all?

A. The purpose of the oxalate experiments running parallel with this was simply to test the information in the literature, of course, to run as nearly parallel with Ferrari and Le Blanc and Darbier, and these other people who had used it before.

Q. That is to parallel other experiments that had been made?

A. Yes.

Q. And had to do solely with the existence of the substance, and nothing to do with its existence in the product of any mill?

A. That's right. It was an independent and entirely separate experiment, just to see if lead suboxide was formed, or what was formed by this compound lead oxalate, which is not a commercial process in any sense of the word.

Q. Don't you think that would tell us—if it confirms it, your hypothesis would be that such a chemical substance did exist—

A. Yes.

Q. —and could be identified?

A. Yes.

THE COURT: All right. I just wanted to get a setting of this. Now, you may go on.

MR. MORRIS: Will you read as far as I got with my question?

(The question was repeated by the reporter as follows:

"Q. If my information is correct, the books in the English language that give substantially accurate statements as to proper techniques to be used in taking and interpreting X-ray 'powder-method' diffraction patterns are, 'The Crystalline State' by W. H. and W. L. Bragg—"

By MR. MORRIS:

Q. To which I will add the following, "The Crystalline State" by W. H. and W. L. Bragg, "A Study of Crystal Structure and Its Applications" by W. P. Davey, and "The Structure of Crystals", by R. W. G. Wyckoff, and "Applied X-rays" by G. L. Clark. Am I right?

A. Right.

Q. No substantial disagreement on this topic among those scientists or authors, is there? They are in substantial accord on the subject?

A. I think so. Of course, I might simply say that my order book is not so exhaustive in any sense in presentation of details.

By THE COURT:

Q. May I inquire which of those books is the most elementary?

A. Well, that is rather hard to say. The Bragg book goes back to 1916, I guess, and it is very easy to read. It is not so exhaustive, possibly, in its details. While I don't want to speak unnecessarily about my own, my own book is meant simply as a broad question of the whole field of X-rays and does not specialize at all in the details of crystal analysis.

Q. If I should ever get to the point that I should want to consult a book, which one will you recommend?

Mr. Morris: Don't be modest.

By The Court:

Q. Don't be modest. I mean, would your book be a good one to read, for me, which is adaptable for some such purpose as this?

A. Well, the original intention of it was for a reader not professionally familar with the subject.

The Court: Well, I guess that is a good answer. I think I would qualify.

By Mr. Morris:

Q. I thought yours was about as easy to read as any of them?

A. I think—

Q. These authors are in substantial accord, I think, you told me?

A. Yes.

Q. My understanding is that your work in connection with this litigation has been done exclusively by the powder method, has it?

A. Yes.

Q. Was your technique in taking and interpreting your powder-method diffraction pattern in connection with this litigation substantially in agreement with

that described in the books that we have just enumerated?

A. Why, insofar as we could, yes.

Q. Is the powder-method diffraction pattern of a given substance one of the characteristic properties of a substance by which it may be identified when the proper precautions are taken?

A. Yes.

Q. What are the precautions in the case of "powder-method" diffraction pattern of an unknown substance?

A. Well, of course, there are—I don't know whether you just refer to experimental, but the sample must be put in proper condition, if it is not already so, so that those smooth powder lines are obtained, so that a good pattern is obtained, and, of course, those lines must be measured with as much accuracy as possible, taking into consideration the width of the lines and so on. And, the attempt made to—if the substance is supposed to be a single powder substance, to make the interpretation, to make the pattern fall together so that all the lines will agree with the single powder substance in the configuration.

If the sample is a mixture, of course, then the attempt must be made to put together those lines, so as they correspond, especially if there is any question as to the—what one of the other constituents might be. It is not easy with the mixture, it is a difficult matter. I don't know whether that answers everything or not.

Q. Would it be helpful, Dr. Clark, if the diffraction pattern of the unknown substance were taken on the same photographic film with the diffraction pattern of a known substance, in such a way that the two patterns are side by side, for example?

A. That is very frequently done.

Q. Is it helpful?

A. It is helpful in calibrating, and in locating in the calibrating any inaccuracy of the camera, because the known substance will, incidentally, give that, and it will give you an approximate idea of the spacings and so forth of the new unknown pattern.

Q. My associate Dr. Davey wants to know whether that known substance that would be used in such a case would not be better, almost indispensable that that known substance be of complete purity, I assume chemically known sample?

A. Yes.

Q. Or the same thing you are searching for?

A. There are standard materials that are often used by X-ray people.

MR. MORRIS: What was that answer, please?

(The answer was repeated by the reporter as follows:

"A. There are standard materials that are often used by X-ray people.")

By MR. MORRIS:

Q. You are speaking of chemically pure substances, one that is chemically known and a chemical standard?

A. Sodium chloride, very pure metallic copper—

Q. I am wondering, if you are doing with diffraction patterns, or something that is interpreted in the light of diffraction patterns. I am assuming the presence of an unknown substance, Pb_3O_4 for instance, and I am wondering whether you would not need to employ on the same film with this diffraction pattern, the pattern of a known substance, that is a chemically known substance?

THE COURT: If Dr. Davey wants to ask a

question, it is all right, as far as I am concerned, if we can save time by it.

Dr. Davey: The intent of the question is not to refer to any calibrating substance, or inaccuracy of film, but in terms of identification of unkown substances. Take, if you want to identify a sample whose chemical composition you don't know at the moment, you can identify it. This is the question, can you identify it, if you take the same films alongside of a diffraction pattern of a substance which you know, and show that the two patterns are identical? For instance, if you wanted to identify an unknown metal, and you would try by the diffraction pattern of that unknown metal, again, for convenience, and compare it with the diffraction pattern of a known metal—

The Court: If you compared it with the diffraction pattern of a known substance, and it turned out that the two were identical, and you wanted to know what the unknown substance was, I could pretty nearly answer that myself, the answer is yes.

The Witness: Yes.

By Dr. Davey:

Q. If you do that too, don't you need to calibrate your film and still compare your readings line by line with the known readings of a chemically known standard material, in other words, to still shown a coincidence? I am speaking in general terms now, not with the identification of material by X-ray diffraction methods, or methods of viewing coincidences of lines between the unknown specimen and the mechanically known material?

A. You mean to exclude all calculations or anything of that sort? You mean just simply a straight identification if you had a face centered pattern, that that was therefore the unknown, the face centered pattern?

Q. What I am driving at, Dr. Clark—

THE COURT: That is all right, if you have a substance that has already been identified, and you are simply—you don't know what it is—and you are trying to check up to see whether it is any of the things that have been analyzed or which are known, but he wants to know if you do that if you are looking for a substance that nobody has identified before?

DR. DAVEY: That is exactly what we are trying to show. There is no magic in this. What we are trying to get the witness to give an opinion on is whether if you have no diffraction pattern corresponding to this unknown substance, unless it is known quantitatively, could you, just by looking at the diffraction pattern, tell what the chemical composition of that substance is, or does it depend on coincidence—

THE COURT: As I understand it, this is what Dr. Davey has asked you, and I think that a whole lot of this passes in our everyday experience. Am I right or wrong when I say I understand that you have arrived at certain lines which, generally speaking, correspond with Ferrari's lines, and in addition to that you have called the whole process and the method by which your analysis was obtained, and the reaction you got—in other words, the history of the product itself, and the various mechanics which you brought to bear on it, that you have used, and you have come to the conclu-

sion that it is Pb_2O, is that the result of your work?

THE WITNESS: Yes.

By THE COURT:

Q. Then, I guess what Dr. Davey wants to know is whether you took Ferrari's pattern and superimposed it or put it side by side with your pattern, or whether you shouldn't have done it?

A. Dr. Davey spoke of actually taking a substance, making a pattern of it.

Q. Yes.

A. A known substance.

Q. Yes.

A. And, of course, we have made the comparison, and in these sheets we have submitted calculations of Cu_2O, Ag_2O, both of which are—they both have cuprous structures.

THE COURT: I don't know whether that will be complete or not.

DR. DAVEY: Can you get from X-ray data alone any information as to the chemical identity of the material if he has no record of the diffraction pattern of the chemically known material which will be made to coincide with it?

THE COURT: Can you answer that question? Is that question a fair question?

THE WITNESS: The only answer to that is to run Pb_2O against Pb_2O.

THE COURT: That is the way it seemed to me.

By MR. WHITCOMB:

Q. What about your oxalate methods?

A. We have obtained a product from oxalate decomposition which has been compared. It is not mixed in with the rest, but it is compared for results and measurements.

By Mr. Morris:

Q. Would you know any more with your oxalate experiment that you had Pb_2O than you would with your lines, or, that the lines you got with your oxalate, you could say that those were Pb_2O any more than you can say that the lines you got in nine, ten and eleven were Pb_2O? We are speaking now of the chemical composition, as I understand it, Pb_2O?

A. Yes.

Q. However, at least until you made your experiments recently, there was no isolated Pb_2O in the world was there?

A. That's right.

The Court: Doesn't it follow that Dr. Davey's questions really defeat themselves if the thing has not ever been done? You cannot identify any substance that way. You couldn't make the discovery.

Mr. Morris: But the lines do not constitute a chemical analysis.

The Court: No.

Mr. Morris: We are speaking of Pb_2O.

The Court: Dr. Clark says that is a substance you cannot reach by chemical analysis, or, nobody can reach it, but that does not mean it does not exist.

Mr. Morris: The question is whether the X-ray can tell you, or, does tell you without any

standard by which to compare it with a known chemical, say, Pb_2O, that you can say that it is a Pb_2O substance that you have.

THE COURT: Yes, that is all right.

THE WITNESS: There are—we have the direct analysis of it in our Cu_2O and Ag_2O, and the analogy of the structure as we derive it from this new substance.

By MR. MORRIS:

Q. You reach a conclusion then as to the chemical composition of these lines, not by a diffraction pattern of this substance alone, but by their relationship to certain other unlike chemicals, but analogous chemicals?

A. That is part of it, and compared with this as a method of chemical analysis, the X-ray certainly tells us that here is a given crystalline structure, and that that crystalline structure is similar or analogous to that which is, well, known as Cu_2O and Ag_2O. Then, we may add to that by any experiments which might be made to indicate the behavior of the substance, change it in any way we can to throw light upon its action.

Q. State the technical term which crystal analysists apply to the powder-method diffraction pattern of chemical element having a face-centered cubic structure?

A. Would you please ask that again, please?

Q. What is the technical term which crystal analysists apply to the powder-method diffraction pattern of chemical element having a face-centered cubic structure? What is the diffraction pattern of a face-centered cubic structure called? Is it face-centered cubic type of diffraction pattern?

A. Yes.

Q. Is this same technical term applied to powder-method diffraction pattern of similar type irrespective of the crystal structure or chemical composition of the substance giving the diffraction pattern?

A. Crystals are classified as they are, for example, in Wyckoff's book, and there is a tremendous variation in the structures, under certain classifications and under certain types, of which there are now a large number, and under any given type of crystal structure we may have, we have actual representatives, for example, in the face-centered cubic type, we may remember, there is silver and gold, they are of the face-centered type. They are, and so are copper, of the face-centered type.

Q. If I understand you, this term is applied, that is the term face-centered cubic type of diffraction pattern is applied to the powder-method diffraction pattern?

A. Yes, sir.

Q. Of similar type?

A. Yes.

Q. Without regard to the crystal structure or chemical composition of the substance giving such face-centered cubic type of diffraction. Am I right?

A. Crystal structures may—it must be face-centered cubic in order to be classified as belonging to the face-centered type.

Q. Will sodium iodide number one give a face-centered cubic diffraction pattern?

A. Sodium iodide at first glance may either change to actual simple cubic, or the appearance is face-centered type, depending on whether the iodides are heavier than the sodiums.

Q. What you mean by that is that the iodides are brought up heavier in the periodic table?

A. Yes, and of course you have the diffractioning standard powders. If we look at the simple cubic lattice, we will see that there are two interpenetrating lines, one of iodide and one of sodium. The iodide will outweigh the sodium line in intensity.

Q. Will you give me the ordinary types of diffraction patterns for crystals belong to the cubic system? Are they, one, simple cubic type of diffraction pattern, two, body-centered cubic type of diffraction, three, face-centered cubic type of diffraction pattern and four, diamond cubic type of diffraction pattern?

A. Yes.

Q. Do these technical terms per se, applied to describe types of diffraction patterns, necessarily imply anything as to the type of crystral structure of a given substance which gives rise to one of these types of diffraction pattern?

A. Well, if we say that a substance has a diamond type of structure, why, that means, of course, incidentally that it is constructed, its crystal structure is analogous to that of pure diamond and belongs to the diamond cubic type.

Q. Does the term itself, for instance, the body-centered cubic type of diffraction pattern necessarily imply anything as to the type of the crystal structure of a given substance?

A. Well, body-centered type is a crystal structure type.

Q. That is, a body-centered cubic type of diffraction pattern means you have a body-centered crystal structure of the substance of which you are seeking the pattern?

A. Yes, has a body-centered type of structure and type of pattern?

Q. Well, do the intensities of the lines have anything to do with interpreting the diffraction pattern?

A. They do, especially in the ultimate analysis in which all positions of the parameter in space are accurately placed.

Q. Is the crystal structure of any substance determined by means of a systematic interpretation of the diffraction pattern?

A. It is.

Q. Does the interpretation take into account both the type of diffraction pattern and the relative intensities of the lines in the diffraction pattern?

A. If we have a single pure substance, then, of course, the pattern of the lines and the intensities which of course are subject to certain conditions and certain variations, both are involved in that interpretation, especially, as I say, if we proceed in the analysis clear through just as far as it is possible to go, to the space group and all parameters in space, or every single atom in the unit cell.

Q. You gave me the number, I think it was four, of ordinary types of diffraction patterns. Will you give me the four most common types of crystal structure? Types of crystal structure in the cubic system?

A. You want those repeated?

Q. No, what I have in mind is I have been advised that the ordinary types of diffraction patterns or crystals belong to the cubic system are the simple cubic type of diffraction pattern, the body-centered cubic type of diffraction pattern, the face-centered type of diffraction pattern and the diamond cubic type of diffraction pattern?

A. Yes.

Q. That is correct?

A. Yes, that is what I said a while ago.

Q. Will you state the technique of interpreting powder-method diffraction patterns? Since the sodium halides, that is, NaF, NaCl, NaBr, NaI, are used as typical examples in some of the books which have

been mentioned. Will you please use them as concrete examples in giving your answer?

A. Of these, three of the four substances, the patterns for sodium chloride, sodium barium and sodium iodide will appear to be very similar, first the lines displace in connection with the increasing sight of halide ion, and the first impression one gets from such a pattern is that of a face-centered sodium bromide, on the order, just as the Rubidium chloride gives a pattern which has all the characteristics we would say of a simple cubic lattice, where all of the distances can be calculated by dividing the lattice by the square root of the sums of the squares of the indices.

The face-centered lattice, of course, is distinguished, that is, the pure face-centered lattice is distinguished by the absence of certain possible lines, by the centered absence of definite lines. Sometimes it is not possible without the data from a single crystal, to interpret correctly or entirely uniquely the finely complicated crystal structures of some kind. In these particular cases we find from the measurement of the lines the correlation, micromatic correlation or relationship that is shown in the spectogram, so that they represent two interpenetrating center-faced cubic lattices, and sodium fluorine ions have precisely the same scattering powders, those two interpenetrating lines will give you a different appearing specter from the other three. The lines can be measured.

Q. I am wondering whether sodium chloride gives a simple cubic type of pattern when only the strong lines are considered, but that there are, besides, very weak lines which, when taken into account, transform the pattern into that of a face-centered cubic type. I am wondering if I am correctly informed about that. I mean NaF, instead of NaCl?

A. Every line of any F will give you a simple

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type of lattice, because we have fluorine ions in the one, one, one planes interspersed between two sodium planes, and acting exactly like a sodium plane.

Q. Let me see if I am right in my assumption that NaF gives a simple cubic type of pattern when only the strong lines are considered. I am right so far, am I not, that NaF gives a simple cubic type of pattern when only the strong lines are considered?

MR. WHITCOMB: Your Honor, I don't think he is going to remember everything without any information. Furthermore, do you want to suggest that maybe there should be some limit?

THE COURT: I don't know how much of this material is going to get into the pan. That is where it has to get, it has got to be fractionated many, many times.

MR. MORRIS: I think, if the court please, he has come to a definite—

THE COURT: I won't interfere.

MR. MORRIS: If you want any of your books—

THE COURT: I won't interfere. It would be presumptious to suggest anything about this testimony.

By MR. MORRIS:

Q. Dr. Clark, perhaps you would rather I deal with NaCl. I am perfectly willing. It is more common, isn't it?

A. Yes.

Q. Suppose we pass to NaCl. The weaker lines of NaCl are somewhat stronger, I am advised than in the case of NaS, but they are still so weak that the simple cubic type of patterns can be picked out easily, from the diffraction pattern?

A. That's right.

Q. As far as NaBr the weak lines are still stronger, as I am advised, so that the face-centered cubic type of diffraction pattern is quite marked?

A. Yes. NaF, I might say, like NaCl, all have lines that enter into the pattern.

Q. Let me see if we agree about NaF at the moment. If you want some reference, I don't think you will, Dr. Clark, but if you do, it is perfectly all right. My information here is that NaF gives a simple cubic type of pattern when only the strong lines are considered, but that there are, besides, very weak lines which, when taken into account, transform the pattern into that of a face-centered cubic type. Is that right?

A. Well, I don't think so for sodium bromine.

Q. You don't think it is true of sodium bromine?

A. No.

Q. The first part you nodded, but did not say yes. You agree that sodium fluorine gives a simple cubic type of pattern when only the strong lines are considered?

A. When all the lines are considered.

Q. When all the lines are considered?

A. Sodium fluorine gives you a series of simple cubic strong lines.

Q. And no weak lines?

A. Not unless it is a beta line or something of that sort.

(Discussion off the record.)

By Mr. Morris:

Q. Let us withdraw that question about sodium fluorine. The sodium iodide, the pattern is clearly that of the face-centered cubic type, both for the rela-

tive positions of the lines and for their relative intensities?

A. Yes, iodide outweighs the sodium.

Q. As shown in the periodic table?

A. Yes.

Q. I am advised that what you have said with regard to sodium compounds is explained by assuming that both the sodium and the halogin each lie on face-centered cubic lattices which attempt to dispatch X-rays independently of each other, each with an intensity which depends largely upon the ionic number of of the ion. All right so far, am I?

A. That is correct.

Q. Thus, since Na plus, and that is positive ions and F negative ions have the same ionic number and nearly the same ionic volume, they have nearly the same dispatching power?

A. That's right.

Q. Those lines in the pattern whose intensity depends upon the difference in dispatching power of the sodium positive ions and the F negatives ions will therefore be very weak. All right?

A. Yes.

Q. And those which depend upon the sum will be strong?

A. Yes.

As the ionic number of the halogen ion, Cl negative ion, Mr negative ion and the I negative ion, is increased the defraction power of its face-centered cubic lattice is increased while that of the sodium positive ion remains the same. Right?

A. Yes.

Q. And the lines which depend on the differences in diffracting power become, therefore, less and less weakened while those which depend upon the sums are less noticeably strengthened. Is that right?

A. Yes.

Q. In this way a series of crystalline compounds of identical type of structure gives diffraction patterns which are of quite different type. Is that right?

A. Please read that first part there again.

Q. In this way?

A. Next.

THE COURT: Read the whole question.

By Mr. MORRIS:

Q. In this way a series of crystalline compounds of identical type of structure gives diffraction patterns which are of quite different type?

A. I should say that there is fundamentally a difference in the type between sodium chloride, bromide and iodide. It is progressive, but the actual pattern I would not say is fundamentally different. There is a progression, there is a change in relative intensity, it is true, but the patterns themselves are certainly analogous.

Q. Many diffraction patterns which are of quite different type may lead, when properly interpreted, to identical types of crystal structure?

A. Well, of course, we couldn't take a pattern which gave exclusively a face-centered type of lattice, and from that say that it is simple cubic. You could never say that lead or gold or something of that sort crystallizes like sodium chloride, although the lines are face-centered cubic. That is, there are peculiarities which come in which are real clues and—

Q. Well—

(Discussion off the record.)

THE COURT: Let us have the answer.

MR. MORRIS: Yes.

THE COURT: Read the question.

(The question was repeated by the reporter as follows:

"Q. Many diffraction patterns which are of quite different type may lead, when properly interpreted, to identical types of crystal structure?")

By MR. MORRIS:

Q. For instance, sodium chloride gives a simple cubic type of pattern and sodium iodide gives a face-centered cubic type of pattern?

A. Well, sodium chloride of course gives the strong lines of the simple cubic, but there are some faint lines.

Q. You are dealing with NaCl instead of KcL.

A. I thought you just asked about NaCl.

Q. It is KcL. instead of NaCl.

A. KcL gives a purely simple type of pattern.

Q. While sodium iodide gives a face-centered cubic type of pattern, doesn't it?

A. Certainly. The lines, unless there be some very, very faint ones, are those of face-centered lattice, yes.

By THE COURT:

Q. Are those two identical crystal spectrums?

A. Both crystallize alike—

Q. Yes.

A. —as simple cubic.

Q. They are actually the same?

A. Yes.

By MR. MORRIS:

Q. I got the impression that there are no weak

lines in sodium iodide. I thought you said so a while ago?

A. I think perhaps Dr. Davey did. I can't remember now as to whether there were very faint lines or not. If there are, they are very faint, I know.

Q. Well, do you agree that the sodium iodide does give a face-centered cubic type of pattern, taking all the lines into consideration?

A. Sodium iodide gives the lines, excluding any very faint ones which I do want to leave, reserve there. It gives a pattern of the face-centered cubic.

Q. All right. Is the structure arrived at by the technique that we have just been discussing, subject to confirmation by showing that density, calculated from the cryst. structure, agrees within the precision of the data with the density of a chemically identified specimen determined in the ordinary way?

A. That is a procedure which is of course very frequently used. The X-ray—intensities calculated from X-ray data gives you an idea value, since the X-ray pays no attention to tracks and voids. In a technique approaching the ideal value of densities very often in crystal structure determinations the values are compared, and one piece of data or datum is compared with the other or confirmed by the other.

Q. You would need such confirmation for purposes of complete identification. I am asking you now as a scientist and not as a partisan, of course, Doctor?

A. I would say it would be very useful to have that data; perhaps not absolutely essential for identification.

Q. And in any case—

A. Well, I may say simply this, oftentimes there may be two alternative possibilities in interpretation, particularly in the selection of space groups. There, the densities are accurately made, and experi-

mental determination might help very much in distinguishing between two alternative possibilities, one which would call for two molecules per unit cell and the other for four molecules per unit cell or something like that.

Q. If there are two or more possibilities, the chemical determination would be essential to a definitely certain conclusion?

A. Well, not necessarily chemical analysis, but what I am speaking of is the X-ray data may not be able to distinguish between two closely allied space groups. There will be no misfake, unless—it is very, very rarely, at any rate—but, sometimes, particularly in complicated crystals, you may not be able to distinguish between one space group and another, or in particular molecular configuration, and then a comparison of the densities is then calculated on the one basis, with the actual experimental data, or a comparison of one with the other.

Q. Dr. Clark, I am lost. That does not surprise me, but I am lost in it here, because what are you going to compare the data with respect to density with where you have two or more possibilities?

A. Well, the densities of course can be certain, if you have arrived at two space groups where one calls, let us say, for four molecular and the other for two, the densities from those two alternative bases can be calculated.

Q. You mean you can determine by mathematical calculation on an assumed hypothesis as to what those intensities should be and you would not need to compare the densities with the chemically identified specimen in order to be certain of your X-ray conclusion?

A. No, that is just what we do do. We compare the actual densities as determined with the spectometer with the calculated ones.

Q. With the calculated ones?

A. Yes, calculated from the X-ray data.

Q. And then is that a prophesy or a determination of what the assumed material is?

A. Well, we have arrived from X-ray data to a certain unit cell, the volume of the unit cell can be known from the X-ray data, the true measurement the X-ray data gives us. Then, if you know the molecular weight of the substance under consideration, of course, the mass of this unit cell will be a number of measurements times the molecular weight times the absolute weight of the hypothetical item, and that gives us the absolute mass divided by the volume.

Q. Suppose you were looking at a powder-method X-ray diffraction pattern of a compound composed in the ratio of one to one or perhaps one to two, of two kinds of atoms, one kind being very light atoms such as hydrogen or oxygen, the other kind being very heavy atoms such as lead barium. Would the positions of the lines in the diffraction pattern depend on the arrangement, in the crystal, of the light atom or of the heavy atom?

A. Well, we could find, in any compound that has hydrogen in it directly, we could find the actual position. Hydrogen would then give us the measured scattering effect—

Q. How about the oxygen?

A. That being sixteen times as heavy as hydrogen, it will be six times as effective. It depends on what the oxygen is compared with.

Q. I am giving you lead barium, or a substance having a very atomic weight?

A. Yes.

Q. Now, would the position of the lines of the diffraction pattern depend on the arrangement of the heavy atoms?

A. It would depend upon the position of the heavy atoms, although we must understand that the position of those heavy atoms is determined, and the distance between them, but the diffraction part, gathering power of the lead is very much greater, and that will predominate.

Q. Assuming two kinds of atoms, one very light like hydrogen or oxygen and one very heavy like lead or barium would the intensities of the lines in the diffraction pattern be seriously affected by the presence of the light atoms? Seriously affected by the presence of the light atoms?

A. Well, other things being equal, not very much.

Q. What are the three types of crystal structure most usually found in the cubic system for crystals of compounds which are made up of equal numbers of each of two kinds of atoms?

A. The body-centered cubic of course is very familiar. The simple cubic such as sodium chloride and so on, and there are some compounds which crystallize.

By The Court:

Q. What does body-centered mean and face-centered?

A. You have a little tube, which is a lattice work. There, you have an atom at every corner of the tube, one on the center of the first one and on the center of every one of the six faces. On the body-centered tube you have seven corners, and you have an atom on each corner and one in the center. A simple tube would be simply an atom in each corner.

By Mr. Morris:

Q. By your answer to my question would you include the zinc blende sphalerite cubic zinc sulphide type?

A. Yes.

Q. Now, then, will you describe the sodium chloride type of cubic structure?

A. The sodium chloride type is a simple tube made up of alternating sodium chloride, like this (indicating). This would be chloride, or sodium chloride, and the next little tube would be again chloride and so on.

By The Court:

Q. What is that?

A. A little principle of crystal chemistry showing this.

By Mr. Morris:

Q. What type of powder-method diffraction pattern does the sodium chloride type of structure give in the general case where atoms A and B have unequal diffracting power?

A. That gives a predominantly face-centered type of lattice.

Q. Will you tell me about the zinc blende sphalerite cubic zinc sulphide? Does that consist of a two face-centered lattices, one of atoms A, the other of atoms B?

A. Let me see—that is essentially correct. I think the one face-centered lattice is displaced one-fourth of the way to the body diagonals, and the lattice, the other three-fourths.

Q. Do these two lattices have their cube-edges parallel, and the B lattice is so placed with respect to the A lattice that the atoms of B fall one-fourth and three-fourths the way along two of the body-diagonals of this A lattice?

A. Yes.

Q. What type of powder-method diffraction does the zinc blende sphalerite cubic zinc sulphide type of

structure give in the general case where atoms A and B have unequal diffracting power?

A. Well, of course, we have a diamond type of structure, but the intensity of the distribution will be conditioned by the exact weight of the alternating zinc and sulphur atoms. Zinc, of course, is about twice as heavy as sulphur.

Q. Well, now, I am advised that that gives a powder-method diffraction pattern of a face-centered cubic type to the due to the face-centered cubic configuration of the atoms having the greater diffracting power. Is that correct?

A. The zinc is of a face-centered lattice, and the predominating structure of the lines correspond to it.

Q. Then my last question is correct, the statement in my last question is correct. What are the two types of crystal structure most usually found in the cubic system for crystals of compounds which are made of two kinds of atoms in the ration of 1 to 2 or 2 to 1? My information is that the cuprite cuprous oxide structure and the fluorite calcium fluoride structure. Is that information correct?

A. Yes, I believe that's right.

Q. Describe the cuprite cuprous oxide type of structure? My information on that is, I will read it in the interest of expediting the examination. The cuprite curprous oxide type of structure has a face-centered cubic lattice of A, of copper in the case of cuprite, with two atoms of B, of oxygen in the case of cuprite, situated on a single body-diagonal of the face-centered cube. One of these atoms of B is one-fourth the way along the body-diagonal—the other is three-fourths the way along that same body-diagonal. Strictly speaking, I have described one-eighth of the true unit of structure. The other seven cubes comprising the rest of the true unit differ from the one

I have described only in the choice of the body-diagonals, along which the atoms of B lie.

Is that correct?

A. Yes.

Q. What type of powder-method diffraction pattern does the cuprite cuprous oxide type of structure give in the general case where atoms B have less diffracting power than atoms A. I would be glad to read you what my information is on that.

A. Yes.

Q. In the general case in which atoms B have less diffracting power than atoms A the cuprite cuprous oxide type of structure gives a powder-method diffraction pattern of a face-centered cubic type, due to the face-centered cubic configuration of the atoms of

A. Correct?

A. Correct.

Q. My next question is to ask you to describe the fluorite calcium fluorite type of cubic structure. My information with regard to that is the fluorite calcium fluoride type of structure contains three face-centered cubic structures, one of atoms A and two of atoms B. The two of atoms B are placed in such a way that atoms of B come at points situated one-fourth and three-fourths the way along each body-diagonal of the cube of atoms A. Is that correct?

A. Yes.

Q. What type of powder-method diffraction pattern does the fluorite calcium fluoride type of structure give in the general case where atoms B have less diffracting power than atoms A?

My information is that in the general case where atoms B have less diffracting power than atoms A, the fluorite calcium fluoride type of structure gives a powder-method diffraction pattern of a face-centered cubic type because of the face-centered cubic configuration of the atoms of A.

Is my information correct?

A. Yes.

Q. Which of these four structures was supposed by Ferrari to explain the data which he obtained for his so-called Pb_2O?

My information is, the last, namely the cuprite structure? Is that your information?

A. Yes.

Q. If a cubic crystal, composed of equal numbers of atoms A and B has the sodium chloride type of structure and if the A atoms are very heavy, like barium or lead, and if the B atoms are very light like oxygen, what type of X-ray powder-method diffraction pattern would be obtained?

My advice is, a face-centered cubic diffraction pattern corresponding to the configuration of the heavy atoms A would be obtained. Correct?

A. Yes, sir.

Q. If a cubic crystal, composed of equal numbers of atoms A and B has the zinc blende sphalerite cubic zinc sulphide type of structure and if the A atoms are very heavy, like barium or lead, and if the B atoms are very light like oxygen what type of powder-method X-ray pattern would be obtained?

My information is, a face-centered cubic diffraction pattern corresponding to the heavy atoms A?

A. Yes, sir.

Q. If a cubic crystal, composed of two atoms of a heavy element A for every atom of a light element B, has the cuprite cuprous oxide type of structure, what type of powder-method diffraction would be obtained?

My advice is, a face-centered cubic diffraction pattern corresponding to the configuration of the heavy atoms A?

A. Yes, sir, that is essentially right.

Q. If a cubic crystal composed of one atom of a very heavy element A and two atoms of a very light element B has the fluorite calcium fluoride type of structure, what type of powder-method diffraction pattern would be obtained?

My advice is that a face-centered cubic diffraction pattern corresponding to the configuration of the heavy atoms of A.

Is my information correct?

A. Yes.

Q. All four of these types of structures (sodium chloride, zinc blende, cuprite, and fluorite) give identically the same type of diffraction pattern if atom A is heavy with respect to atom B, do they not?

My information is that they do. Correct?

A. Yes.

Q. And if the atoms of A are very heavy with respect to the atoms of B, the diffracting power of the atoms of B will be negligibly small in comparison with that of the atoms of A, that is correct, is it not?

A. Yes.

Q. So that in all four hypothetical cases which you have just discussed, if atom A is very heavy with respect to atom B, the powder-method diffraction patterns will not only be of the same type but will have substantially the same intensities of lines?

A. Yes, in general, that's right.

Q. In the atomic weight, or, if you choose, the atomic number of oxygen is very low, is it not?

A. Yes.

Q. The atomic weight, or if you choose, the atomic number of lead is very low, is it not?

A. The atomic number, yes, sir.

Q. Then, if you were given a lead-and-oxygen compound of unknown composition, and if you found that it gave a face-centered cubic type of diffraction

pattern, you could not tell from the diffraction pattern alone whether the compound had the sodium chloride, the zinc blende, the cuprite, or the fluorite type of structure, could you?

The information I have is that you could not. Is that correct?

A. If you had just that data and nothing else, I suppose not.

Q. What other data would you—what other data would make your answer comply?

A. If you had any idea of the atomic dimensions, that would be helpful.

Q. In the specific case of a lead and oxygen compound giving a face-centered cubic type of diffraction pattern you could not tell from the X-ray data alone whether or not you had a cubic form of PbO or a cubic form of PbO_2 or a cubic form of so-called Pb_2O, if such exists, could you?

THE COURT: What was that question?

By M MORRIS:

Q. In the specific case of a lead and oxygen compound giving a face-centered cubic type of diffraction pattern you could not tell from the X-ray data alone whether or not you had a cubic form of PbO or a cubic form of PbO_2 or a cubic form of so-called Pb_2O, if such exists, could you?

A. If such exists, is one matter, but however, the lattice constant atoms would be different, even if it gave the face-centered cubic lattice in all cases, the lattice constant would be distinctly different for those three.

Q. Meaning thereby—

A. That is the distance between the lead atom depending on the number of oxygen in between, and the area of the oxygen, and so on.

By THE COURT:

Q. Is that the A subzero you were talking about?

A. Yes.

Q. What other data would be necessary to supplement the X-ray diffraction data in order that the unknown substance may be properly identified?

THE COURT: Have you said that it could not be properly and completely identified by the X-ray alone? The judge assumes that that is your answer, but was your answer quite that?

THE WITNESS: I would certainly place very high, if not first on any list, for purposes of identification of unknown substances, the X-ray results.

By MR. MORRIS:

Q. That is above chemical results?

A. Well, chemical results, if they could be obtained very accurately would certainly be very helpful in case there would be no information about the pure compound, no information about the actual number of atoms, or which kind they were, or the actual formula, the molecular weight and so on. That is, of course, the first essential.

Q. The ionic dimensions?

A. The ionic dimensions, yes.

Q. How much help would the ionic dimensions give you?

A. Those ionic dimensions are very frequently used for measuring the packing within the given volume, for example, if a volume—if you arrived at certain results, or think you have reached a certain result, that may be entirely incompatible with the packing in the given volume of a certain number of atoms;

unless those atoms are subjected to some very peculiar distorting force of some kind.

Q. If you were using the ionic dimensions, I assume that the authorities agree with regard to such dimensions, or am I wrong about that?

A. They were not constant under all conditions. Dr. Davey—

Q. Then you would have set from Bragg, and one from Dr. Davey, and another from somebody else?

A. There has been no set of constants set up for any ionic measurements. We are coming along, and this thing should give you a very good rough idea.

Q. That being true, will you select Davey or Bragg or somebody else's way to test the ionic dimensions? It wouldn't make any difference which you selected because it would be subjecting your yardstick to such a constant source—

A. Yes, that's right.

Q. I am right, am I not?

A. Yes.

Q. So that again you would be using an electric yardstick in determining the existence of this assumed newly discovered compound. You wouldn't be very sure of yourself, Dr. Davey, if you were using such a yardstick as that?

A. That is true, it is only for the reference.

Q. Did Ferrari make a quantitative chemical analysis of his material to show that it was Pb_2O?

A. I believe he did, yes.

Q. If you can find out, I wish you would show it to me because I have been looking for it, and I thought it wasn't shown. I thought he also had impure material?

A. That is true, there is no question about that.

Q. Dr. Davey calls my attention to the fact that I called you Dr. Davey. I am not sure whether you

may like it, but, may I apologize and call you Dr. Clark?

A. I am highly honored. We have been friends for many years. This notation reads, "It appears very probably that the first product was the suboxide in question. The analysis of the product shows, the lead being determined as sulphate. The lead content is less than that calculated for Pb_2O. In one hundred parts, lead found 93.83 calculated for Pb_2O 96.40, for PbO 92.82."

Q. He does use the term "calculated as Pb_2O?"

A. Yes.

Q. And you knew Mr. Ferrari had been able to repeat his experiment?

A. I don't know.

Q. You have not been advised that he has been able to repeat it?

A. No, I think two years ago I had a very brief correspondence with him in which he simply stated he maintained his stand.

Q. You would not base your professional reputation on his test alone, would you, Dr. Clark?

A. Not on his test alone, no.

Q. As far as you know he never made but one?

A. Just what do you mean by test?

Q. Well, I am speaking of Ferrari now?

A. Yes.

Q. And his publication, as far as you and I know, we know he didn't repeat the test or experiment, as far as you and I know? He never made but one?

A. That is all I know about it.

Q. You would not bank or bet very much on such an experiment?

A. No, not very likely.

By The Court:

Q. He did, didn't he?

A. Yes, he did.

By Mr. Morris:

Q. I am wondering how much you predicate your conclusion on that one of Ferrari's? Would you mind telling us?

A. I will tell you, Judge Morris, when I—as I said—I started from zero on this. I experimented with this, and when these same lines began to appear, they didn't seem of very much consequence, but, just then, after the results piled up, and I started to make certain comparisons of lines, and things which I have lived with continuously through about four years of striving to get a purer product so that I would be sure—

Q. Were you remaining wholly impartial in your attitude, or were you working for plaintiffs during that four years?

A. No, this work on this sort of thing began in my laboratory purely as an experimental problem. It was commenced before any connection with plaintiffs.

Q. Did you ever find anything that gave you really any encouragement for your Pb_2O line until the last two months say?

A. No, I felt from the completion of the results, I am perfectly willing to admit, I felt that this one sample would be compatible with Ferrari's, but when this experiment was completed, the crucial moment came when this pattern was produced free from lead and free from PbO, I felt that my work was complete, and I feel, for myself, sure of what I have found.

Q. Now, then, I would like to ask you a little about this experiment on Monday morning, if I may?

By The Court:

Q. I want to get an idea of how you started on this

work. Did you start out with the idea of ascertaining the existence of Pb_2O four years ago?

A. Yes, that was partly in the picture. I have, of course, a large number of students doing X-ray work, and when this controversy came out in the literature, we were interested in the qualitative analysis and various chemical purposes. I just happened to come across it, and it seemed to be more a problem we assume independently, because of the conflict between the two men.

Q. What two men?

A. Van Arakel and Ferrari.

Q. At that time were you advised of the commercial setting of this thing at all?

A. Not until some period later. We, of course, differ—

Q. For instance, when you started that, did you know anything about how lead powder was used in storage batteries?

A. Only in a very indirect way. We have become interested in the whole chemistry of the storage batteries, and if we can find out something about them with this method that is the thing.

Q. Well, I mean four years ago?

A. No, the thing simply began purely as an inorganic chemistry problem.

Q. Four years ago did you know how plates of a storage battery were made?

A. Just as we would teach a chemistry student, that's all.

Q. You didn't know how they were made?

A. Yes.

Q. You did know they were made of paste, and lead powder and so forth?

A. Yes.

THE COURT: I just wanted to get a general

idea of where this fitted in with your general knowledge. All right.

(Adjourned to Monday, October 7, 1935, at 10:00 o'clock A. M.)

GEORGE L. CLARK, recalled.

MR. MORRIS: I have no further questions of Dr. Clark.

Re-direct-examination.

By MR. WHITCOMB:

Q. I notice on some of those films you have introduced, particular those showing the illustration of the suboxide, I believe you have referred to around a 2.61 line, or something like that,—

A. Yes.

Q. —that it is a little wider, it seems wide to you compared with some of the others. Will you please go ahead in your own way and explain to the Court what in your opinion all that means?

A. Yes. The other day we were speaking in some detail of face centered cubic lattices, and the fact that the cuprite type of lattice would give a face centered type of pattern. When, however, we come to notice the numerical data from our experiments on the films which we have done, which we have made, we find that there is not a perfect check of these data. For instance, on the sheet marked "Corrected and Revised Measurements of Spacings" we find that those numbers—

Q. Has that an exhibit number?

A. That is just a copy—those spacings do not fall accurately upon a face centered cubic type of pattern.

Professor Davey has a method of using a slide rule, where he turns the slide upside down, and with a face centered cubic lattice, for example, if we plot the first line opposite number three, then all the other spacings should fall opposite integers on the reverse slide.

Q. Is that slide rule method illustrated in Dr. Davey's book?

A. Yes, it is. Now, that worried me a good deal at first. The second number in the list for this so-called suboxide is 2.61. In the work of Ferrari, however, this value is 2.69. If that is multiplied by two that gives the 5.38 which we mentioned the other day.

Now, if we examine the microphotometer curves on various samples which we have prepared we find that this second spacing, 2.60, sometimes 2.61, sometimes 2.62, 3, 4, 5, up to 6, and I have never succeeded in getting it up to 2.69, but the average value, that is, the value which seems to be most predominant, is about 2.609 or 2.61.

Now, of course, that instantly suggests a variability, a variation in a product which is being formed in the system lead-oxygen, and if those numbers do not fall perfectly together, in the sense of a perfect face centered lattice, that it illustrates a peculiar type of, we might say for the moment, distortion. In the last film which was introduced, a filtered one, there is—

Q. Will you get that film?

A. The last exhibit.

Mr. Whitcomb: Would you mind if the witness picks it out?

The Court: Yes, sure.

By Mr. Whitcomb:

Q. Would you mind coming over?

A. It is the very last film in the exhibit.

Q. Will you come down this way?
A. Yes.

(The witness produced the film.)

By Mr. Whitcomb:

Q. And, by the way, does this film show that wide line that I mentioned on my first question?

A. Yes, this very strong, strongest line there, appears to have on its one side a whole lot of other lines very close together. It is very broad and diffuse. Now, with these calculations in a film like this the next situation is one of trying to explain such a state of affairs. Of course, there are, I think a good many evidences among X-ray people of patterns in which lines are shifted. For example, in the paper by Le Blanc and Eberius, upon the existence of lead suboxide Pb_2O, we find two spectra from his work in which the lines, some of them, are considerably shifted one from the other, that is, a PbO tetragonal lattice, and then his material which he obtained by the decomposition of lead oxalate.

In the Ferrari paper the thing that interested me most is this:

> "The diameter of lead which is calculated from the reticulum of the suboxide is instead of 3.36 . . . close enough to that of metallic lead 3.48 . . . to admit that the lead in this reticulum is in the metallic state and not that of the monovalent ion."

Now, taking that statement as it stands, of course, that would distinguish Pb_2O from Cu_2O and Ag_2O, where, of course, the ionic dimensions, even although they may be rough, are clearly those of an ionic copper and silver in an ionic state.

In 1932 there appeared in the "Zeitschrift Für Physikalische Chemie", volume 160, page 69, a paper which has the German title "Untersuchungen über Bleioxyde und deren Systeme mit Sauerstoff"—researches on lead oxides and their systems with oxygen—by Le Blanc and Eberius. Le Blanc, of course, is a very, very prominent chemist, whose reputation has been long established. This in many respects is one of the most remarkable papers ever published, a paper about forty pages long, and because of the length of it I will read the abstract of this paper as it appeared in Chemical Abstracts:

> "There are two forms of PbO, a red form stable below 585 degrees, and a yellow form stable above. The rate of transformation, yellow to red, at room temperature depends on the mode of preparation, and is increased by the application of pressure. Between 200 and 390 degrees both forms take up oxygen without the appearance of a second solid phase, until the composition reaches $PbO_{1.7}$."— sub 1.7. "The original lattice"—that is, the tetragonal red PbO lattice—"persists up to about $PbO_{1.43}$, when it is replaced by a lattice that is different from any of those hitherto observed in the system lead-oxygen, and is identified with a dark colored modification of Pb_3O_4."

Incidentally, if I may divert for a moment, this process was patented in Germany in 1933, and this new compound made by this method is now being manufactured under German patents for the purpose of pigaments, a black form of Pb_3O_4.

> "From $PbO_{1.33}$"—sub 1.33—"the absorption of oxygen is reversible, and the form of the lattice unchanged:"—the form of the lattice un-

changed—"the pressure curve shows no discontinuity at the composition Pb_2O_3. When oxygen is removed the pressure falls continuously until $PbO_{1.33}$ is reached, when PbO appears as a second solid phase and the pressure becomes constant. If a solid phase between $PbO_{1.33}$ and $PbO_{1.66}$"—which means, of course, a continuous series, $PbO_{1.33}$, $PbO_{1.34}$, $_{35}$, and so on—"is heated above 389 degrees it gives off oxygen and forms ordinary red Pb_3O_4, which cannot take up an excess of oxygen. The transformation black to red Pb_3O_4 is monotropic. When oxygen is removed from PbO_2 by heating at a fixed temperature the PbO_2 lattice"—that is, lead peroxide—"persists until the composition is about $PbO_{1.66}$, when it is replaced by the lattice of black Pb_3O_4. Since further the pressure curve is continuous there is no reason to believe that a compound Pb_2O_5 exists. The loss of oxygen up to $PbO_{1.66}$ is irreversible, and PbO_2 cannot take up an excess of oxygen."

In other words, when you reach PbO_2 no more oxygen will go into it.

"Oxides from PbO"—that is, Pb one, O one—"to $PbO_{1.10}$ dissolve in nitric acid, those between $PbO_{1.12}$ and $PbO_{1.4}$ leave a residue of dark $PbO_{1.66}$".

Now, the significance of this article, I have examined it many times, I cannot see any experimental flaw in it anywhere, every compound has been analyzed both for lead and for oxygen in the system, there has been complete X-ray work upon the whole system, and it indicates, contrary to the shades of John Dalton, that we have a unique situation in the system lead-

oxygen, in other words, that oxygen is taken up continuously, clear up to PbO_2, with these various peculiar conditions, that is, the transformation from one lattice form to the other, as have been briefly indicated here.

Now, the only other type of material that does this same sort of thing, apparently are some experiments on cobalt oxides, which give somewhat analogous results, in the sense that the absorption of oxygen is continuous. Now, this particular paper starts with PbO, pure PbO; obtained by vacuum methods, of course, so that there would be no excess of oxygen. Then the pure PbO is submitted to the effect of oxygen gas, with these results.

Now, we have in our X-ray studies an example of one substance entering the lattice of another, producing a distortion. It is a field that is comparatively new yet, it is a difficult one, but if we take the case of Martinsite, which is the component in steel, of hardened steel, which carbon combines with alpha iron continuously, over a whole range of compositions, producing a distortion in the original cubic lattice, and giving a whole successive range of tetragonal lattices, one right after the other, as we take a chunk of iron and put it into a carbon atmosphere, you have a complete variation in the amount of carbon in the X-ray spectrum and everything else, from the outside, where the carbon concentration has been a maximum, inward into the solid, into the solid metal.

Now, therefore, to make the thing as brief as possible, we have found certain peculiar variations and a certain continuity in the uptake of oxygen by metallic lead. In these particular mill samples, there is apparently a type, a peculiar type of distortion of the lattice, which retains fairly well the general form of a face centered cubic lattice, but it is slightly distorted

in the fact that this 2.6 spacing lags a little bit behind some of the other spacings as oxygen enters. Now, if that is true, therefore, if metallic lead takes up oxygen continuously, just as it does, certainly, through these oxides clear up to PbO_2, then it follows that we may have a range, a whole range of face centered cubic lattices from pure lead on up to Pb_2O, or somewhere between Pb_2O and PbO, or a transformation from a face centered cubic lattice, either distorted or not distorted, takes place to the tetragonal type. Now, therefore, a suboxide of lead can just as well be Pb one million O—

By Mr. Whitcomb:

Q. That is Pb sub one million?

A. Sub one million.

Q. Capital O?

A. Capital O: Pb one thousand O, Pb one hundred, Pb_3O, Pb_2O, $Pb_2O_{.95}$, with a continuous—with a continual uptake of oxygen and suboxide—a face centered cubic lattice, distorted or not.

Q. Now, in the patent in suit, the patents in suit, the patentee uses the term "suboxide", is that right?

A. He uses, in all of the claims the word is written out, lead suboxide.

Q. And your point is that does not need to be technically absolutely Pb_2O, but might be one of these others?

A. As long as metallic lead begins to take up oxygen and takes up oxygen continuously over a whole range of contents, just as I have tried to make clear in the theory from the beginning, that the original thing with the absorbed oxygen layer is for oxygen to enter the face centered lattice, and if one oxygen atom enters the face centered cubic lattice, so little, in fact, that you cannot distinguish the X-ray pattern at all

from metallic lead, still, if that oxygen is in that lead lattice, it is a suboxide of lead.

Q. And you believe that you have found that in these samples that you have taken of the Exide mill, and Prest-O-Lite, and so on?

A. Yes.

Q. Then could you express the chemical formula for what you think suboxide means?

A. Lead suboxide is a taking up by a face centered lattice of lead of oxygen in contents, any content or ratio of lead to oxygen such that the ratio of lead to oxygen shall be greater than one to one, in other words, two to one, three to one, ten to one, and so on.

Q. And just one more question.—

By The Court:

Q. Would that refer to a case like Pb_3O_2?

A. Pb_3—yes, just so the ratio is more—

Q. That would be within your definition?

A. —than one to one, yes.

By Mr. Whitcomb:

Q. And what is the total import of this redirect testimony, then, from your point of view?

A. Well, I feel simply this, that with the experimental background which we have it is perfectly fair to say that the study of distorted lattices, these so-called solid solutions with X-rays, is a difficult one, it explains why the lines have been so broad and faint, and yet it comes, it seems to me that it comes within the entire range of possibilities that if oxygen is taken up in this continuous or more or less continuous fashion by metallic lead, starting with a very high ratio of lead to oxygen, clear up to the place where PbO ensues, now, it is entirely possible, we don't know that, but it is entirely possible by analogy with PbO_2, PbO_2

takes up its characteristic lattice form at $PbO_{1.66}$, it is entirely possible that tetragonal lattice might take up its rearrangement or its form at something, a ratio a little on the lead side, under one to one.

Q. That is, you mean by the tetragonal, PbO?

A. Yes.

Q. On your cross-examination you discussed certain crystalline compounds. Were there four of them, do you remember the ones?

A. You mean ones that had—

Q. Similar—

A. —face centered cubic—

Q. Yes.

A. —lattices.

Q. Or was it three? What were they, do you remember?

A. Well, they were of four compounds that would give a face centered lattice, such as CaF_2, and, let's see, calcium fluoride, and cuprite, Cu_2O, and sodium iodide—I have forgotten what the other one is.

Q. What is that blend?

A. Zinc blend, yes.

Q. In your opinion is there any possibility whatsoever of any of those substances having been in this material you tested, knowing—

A. None—

Q. —what you start—

A. —of those combined with oxygen or vary in any way. We are in a range of lattice dimensions here which distinguishes a metallic lead lattice, which is taking up oxygen.

Q. Then in your opinion those distances you measured eliminate any possible conflict with those other lattice-works, is that right?

A. Why, yes, that is, calcium fluoride does not take up oxygen, nor does sodium iodide, or anything of that kind in this variable manner, so far as we know.

Q. Now, those were four, I believe. How many possible substances are there that will take a crystalline form, anyway? Can you give the Court some idea?

A. Well, it would be hard to estimate the number of chemical compounds at the present time. It would be up into the hundreds of thousands, half a million or more.

Q. And of these, then, these are the only four that come within this form, in any event, is that right?

A. Yes.

Q. And as to those four that "a sub zero" line makes a complete differentiation, according to your testimony, is that right?

A. Well, of course, in dealing here with a variable, with a variable material, I have never succeeded in getting up to Ferrari's number 5.38, the nearest we can come to that is 5.33, but I think the distinguishing feature is the evidence of a lattice distortion and of a variability in the system Pb-O, just depending upon the particular way in which we happen to get the specimen.

Q. There is one other question, when the lead takes on the oxygen when would you say the crystalline structure takes on form PbO?

A. Well, there is no experimental data upon that at the present time. I just mentioned a while ago by analogy with PbO_2, which is, I think, undoubtedly correct,—

By The Court:

Q. Well, that is just repeating what you said?

A. Yes, same thing.

The Court: I understood, at least, I think I understood it.

Mr. Whitcomb: I think that is all.

Re-cross-examination.

By Mr. Morris:

Q. If I understand you aright, now, Dr. Clark, you are explaining by your testimony this morning why you do not have Pb_2O?

A. We have Pb_2O as only one compound in an infinite series, practically.

Q. So if in your testimony during this trial so far you have said that you have, that Shimadzu had Pb_2O, and the defendant had Pb_2O, then you have picked out a single one, been able to pick out by your process and method a single one of an infinite series, and say that Ferrari had it, that Shimadzu had it, and that Electric Storage Battery had it, am I right?

A. There is present just as near to Pb_2O as—that is the most stable configuration, of that there wouldn't be any question.

Q. Now, since there is an infinite series and you haven't had any Pb_2O to analyze chemically, how do you know that this is Pb_2O that you have been referring to hitherto in this case?

A. Pb_2O, we approach a stable cuprite type of lattice, where you have—the configuration is such that there are two leads to one oxygen, we have a variation from that.

Q. Now, I gathered from your testimony this morning, Dr. Clark, that before you could have a cuprite structure or type of lattice that you must have a face centered cubic type of pattern?

A. Yes, exactly.

Q. And I gathered from your testimony this morning that you have now departed from that, and say that you do not have that, in that your lines, do not correspond with Ferrari's lines, and in that the measurements show a departure from the face centered type of cubic pattern. Am I right?

A. They depart in the sense that a slight distortion of the face centered cubic lattice occurs.

Q. Well, it either is or is not a face centered type of cubic lattice, and if I understood you aright, until this, until you took the stand this morning, you have never dealt with any distorted face centered type of cubic lattice, have you?

A. Nobody has ever inquired into these figures. We were just speaking in a perfectly idealized way.

Q. I know, but Dr. Clark, you were telling us that we had a face centered type of cubic lattice. Now, then, when we ask you about the figures you tell us, no, you don't have a face centered type of cubic lattice, you have something that approaches it. As I understand your testimony this morning, you have entirely shifted your position. Am I right?

A. I haven't shifted my position at all.

Q. Well, then, you—

A. I have just tried to explain it, or to amplify it, that is all. I have known this, of course, all the time, for months and months and months.

Q. It seems strange that you didn't tell us in the beginning, Dr. Clark, that you didn't have a face centered type of cubic lattice, but had something that approached it.

A. It is a face centered type of lattice, yes.

Q. When does a type of lattice depart from the face centered type, how much margin would you give it before it passes into some other type?

A. Well, until—until the essential pattern completely changes over in some other—

Q. Oh, then, you haven't the cuprite structure here at all, because that is truly a face centered one, isn't it?

A. Cuprite, yes, cuprite type of structure is a pure face centered type of lattice.

Q. And I read in Dr. Wilson's report that you had reported to him that you had a cuprite structure?

A. Cuprite type of structure, exactly.

Q. Now, then, you tell us this morning that you do not have that, but something that approaches it, am I right?

A. Well, that is right, yes.

MR. MORRIS: That is all.

Re-direct-examination.

By MR. WHITCOMB:

Q. Well, by that last answer you mean it is still that type, you stick to the—

A. Why, sure, it is a face centered type of lattice.

Q. But more or less distorted?

A. Yes.

Q. Then you rely on your original explanation of the lead first taking on the oxygen, and so on, changing—

A. Exactly.

Q. —over from one to the next, and finally, when it, as you say, takes a shape that could no longer be said to be a mere distortion, but it is an entirely new shape, then you get out of your type?

A. Yes.

MR. WHITCOMB: No further questions.

RICHARD S. GARTON was called as a witness on behalf of the defendant and, having been first duly sworn, testified as follows:

Direct-examination.

By MR. MORRIS:

My first name is Richard, Richard S. Garton. I

am an employee of the defendant in this case. I have been for thirty-five years. The line of my duties is in charge of the Construction Department in the New York territory. These papers that you hand me are in connection with the work that I was in charge of at that time. I know that the batteries referred to in there were installed. I know that they were put into operation. I know about the date that the special positives were installed. That date was starting in February, 1917, and continuing for about three months, that is, special positives and special negatives. I remember the markings on those batteries or plates. The trays were marked B; the plates were marked I J B for the positives and I J I for the negatives. I know that the batteries so made were used by the New York Railways.

(The following documents, offered by counsel for defendant were thereupon received in evidence and marked Defendant's Exhibit number 110:

"Photostat of letter dated December 1, 1916, from Manager of Construction Department to Mr. R. S. Garton; photostat of letter of December 2nd, 1916, from Manager of Construction Department to Mr. R. S. Garton; copy of letter dated December 11, 1916, from Manager Construction Department, to Mr. R. S. Garton; photostat of letter dated December 14, 1916, from Operating Department, Engineer-in-charge, to Mr. Welcke; copy of letter dated February 19, 1917, from Manager Construction Department to Mr. R. S. Garton; photostat of letter dated May 6, 1918, from Manager of Construction Department to Mr. R. S. Garton; copy of letter dated June 14th, 1918, from Manager of Construction Department to Mr. R.

S. Garton; photostat of letter dated June 13, 1918, from Operating Department to Mr. Hodge; copy of letter dated June 11, 1918, from Manager of Construction Department to Mr. R. S. Garton and copy of letter dated June 3rd, 1918, from Department of D. and D. to Operating Department; Mr. Lesley.)

Cross-examination.

By Mr. Whitcomb:

I know what these papers are. They are in connection with the work that I was on. I got the originals from Philadelphia. I received all of these letters myself. There are none there written by me. I myself knew what material was in these special positives. I was located in New York City. I did not see the material go into the plates before they were formed in Philadelphia.

J. Lester Woodbridge was called as a witness on behalf of defendant and, having been first duly sworn, testified as follows:

Direct-examination.

By Mr. Morris:

My residence is in Philadelphia; occupation, Chief Engineer of the Electric Storage Battery Company. I have been such Chief Engineer for about thirty years.

I have had some experience in comparing technical documents one with another and processes one with another. Among my duties is the comparison of technical descriptions that appear in patents related to the business of the company, the preparation of brief ab-

stracts of those descriptions for filing in our technical library, the preparation of technical descriptions of processes and apparatus for use in preparation and prosecution of patent applications. Apart from my experience with the defendant, I had the following training: I was graduated from the Brooklyn Polytechnic, in 1884, with the degree of B. S.; from the Stevens Institute of Technology, in 1886, with a degree of Mechanical Engineering; and in 1923 the degree of Doctor of Engineering was conferred upon me by Stevens Institute.

I have read the patents in suit. I understand them except for certain ambiguities and contradictions which I do not think anybody can understand.

MR. WHITCOMB: I move to strike out the last part of the remark, Your Honor.

THE COURT: Well, no, he is called for his opinion. If he thinks the patents are unintelligible—

MR. BETTS: "Nobody can understand."

THE COURT: —in part he can say so. That is all right, that is a matter of opinion.

(Counsel for defendant here offered in evidence the following translations which were received in evidence and marked as indicated:

(Translation of Japanese patent number 41-728, to Genzo Shimadzu, was marked Defendant's Exhibit number 111.)

(Translation of Japanese patent number 42-563, to Genzo Shimadzu, was marked Defendant's Exhibit number 112.)

I have read the translations of those patents. I believe that I understand those patents.

MR. MORRIS: And I might add at this moment that it is stipulated and agreed by and between the respective parties that these translations are true and correct translations, subject to correction if error should appear.

MR. SCHAFFER: That is correct.

The witness, resuming, testified: Comparing those patents, those translations, Exhibits 111 and 112, with the patent in suit number 149, Shimadzu Japanese patent 41728 describes a process for producing fine lead powder by placing pieces of metallic lead inside of a rotating vessel, rotating the vessel and grinding them to bits by means of the frictional rubbing of the lumps of lead on one another and on the inside of the walls of the vessel. The patent describes the process as follows:

"An iron cylinder 60 inches in diameter and 60 inches in length and which can be made to rotate is mounted horizontally and . . . lead balls having a diameter of one and one half inches thrown into it; then during the time it is rotated at about 25 revolutions per minute, the lead balls rub on one another—

THE COURT: Do you think it is necessary for the Doctor to read the patents? I mean, they are going to be in the record.

MR. MORRIS: May I make a statement with regard to that?

THE COURT: Sure.

MR. MORRIS: It is not necessary to read them, and I think counsel can perhaps do a great deal of this task in their field as counsel, but there is a question involved in these two cases, in these two

patents, and 149, and 150, and 151, and 479, and 020, where the question of lead dust comes in. Now, then, these two patents anticipate and destroy, as we see it, the whole field of the patents in suit, because it deals with lead dust in 41728 apparently as does the first claim of patent 149. The second patent, namely, Exhibit 112, injects air.

The date of the application of 111 was November 21st, 1920, and the patent issued February 13, 1922. No application was filed in America, under 4887, on either of these patents, which cover the whole field, so far as we can see, until long after twelve months had expired. These patents were applied for first, they were issued first, and Section 4887 of the Revised Statutes makes them a complete destroying power of all the suboxide patents by reason of the failure to file within that time.

THE COURT: Do either of these patents mention suboxide?

MR. MORRIS: No.

MR. WHITCOMB: If your Honor please, we want to enter an objection, to apply to all this testimony, namely, that it is the claims, under Section 4887, that must be compared, that is, what is patented in a foreign country is that which is covered by the claims.

THE COURT: Well, I guess you better get me the statute.

(Discussion off the record.)

THE COURT: Well, of course, I will take it subject to the objection.

MR. WHITCOMB: Yes.

THE COURT: I will be glad to know just what the issue is in a general way as we go along.

MR. WHITCOMB: Plaintiff's position is that the claims of those patents cover what was patented, and we have other cases in this country we are going to rely on as well.

THE COURT: Just mere disclosure of the specification—

MR. WHITCOMB: —is not sufficient, and the claims give the "out" which make the patents in this country valid.

THE COURT: Well, that is all right, I am very glad to have had that discussion, but it all arose from the question in my mind whether it was necessary to read very much of these patents.

MR. MORRIS: I don't know that it is.

THE COURT: However, you use your judgment about it.

MR. MORRIS: I am wondering how far your Honor cares to have an expert go, because if you would prefer to have counsel do it instead of having an expert do it I don't know that there is any particular thing in any of these patents that counsel cannot deal with by pointing out—

MR. WHITCOMB: We would be willing to go along the same way on that.

THE COURT: Well, it will save some time if it can be done. If it is a mere question of comparison of the language of the patents I don't see why it requires an expert. If it is a question of interpreting some of these terms, I have reached a

point now where I think I know what lead suboxide is.

MR. MORRIS: Well, I am sure I haven't.

THE COURT: Well, at least, I know what the parties contend that it is,—

MR. WHITCOMB: Yes.

THE COURT: —if I may say that, put it that way.

MR. MORRIS: Well, I thought I knew until Dr. Clark testified this morning, and then he gives us such a new picture from anything we had before; but I think in these two, if your Honor please, there is a question of interpretation of lead powder.

THE COURT: Well, there are the words "chemically reactive powder", manufacturing chemically reactive lead powder in the claim. Well, you go ahead.

MR. WHITCOMB: Do you want to inject any law here as we go along? That is the very point in the Third Circuit Court of Appeals case we rely on.

THE COURT: What is the case?

MR. WHITCOMB: Altoona Publix Theatres vs. Tri-Ergon, 72 Federal Second, 53.

MR. MORRIS: Which I happened to be in, and was unfortunately reversed by the Supreme Court of the United States.

MR. WHITCOMB: Not on that point, on validity.

MR. MORRIS: But the case was reversed.

THE COURT: All right.

MR. WHITCOMB: "There are many features disclosed in the German patent which are not claimed, and in law the patent stands as though the features were not disclosed", citing the Supreme Court case, Davis-Bournonville vs. Alexander Milburn.

"All of the above-mentioned elements, not disclosed in the German patent, coact with all the others in the combination. If they were eliminated, the results of the combination could not be obtained. It is evident that we have in this patent a combination and method not disclosed in the German patent."

That is the essence that I read first.

THE COURT: Yes, well, all right, Judge, you will have to use your own judgment about it.

The witness, resuming, testified: Comparing the two exhibits, Defendant's 111 and 112, with the patent in suit, 149, for the purpose of stating what is meant by lead powder in the claims, in my opinion the term "lead powder" used in these three exhibits means a powder derived from or containing lead, not necessarily in the form of metallic lead, but lead in some partially oxidized condition, and I am basing that opinion on the testimony of the experts that have already been heard, to the effect that no product can be obtained from a rotating mill of this kind, under the conditions described, unless the lead is partially oxidized.

I also find an example of the use of the term "lead powder" with this definition in the file wrapper and contents of patent 020, page 38, second paragraph, which reads as follows:

Applicant revolves his tumbling mill, thus causing the lead particles to grind off the lead suboxide formed on the surface. Applicant finds that by keeping the lead suboxide ground off as fast as it is formed and then blowing it out of the mill he can produce this powder in its best form, but, as the Examiner knows, lead powder is poisonous in the air, and to prevent it from impregnating the air surrounding the mill applicant separates the powder from the air by passing the mixture of air and powder through a filter.

The term "lead powder" is referred to in the line where it says lead powder is poisonous in the air; is used as referring to the partially oxidized lead powder

MR. WHITCOMB: If Your Honor please, I object to the use of the file-wrapper arguments. As I understand, file wrappers are admissible principally only for showing estoppel, or something like that.

THE COURT: Well, I will note your objection and take it subject to the objection.

I find on line 4 of page 2 of the patent in suit 479, the expression "lead suboxide", and in parentheses Pb_2O. That is page one, line 4 of patent 479. I do not find in either patent 149 in suit or in Exhibits 111 and 112 any limitation upon the amount of oxidation which might take place in either of those three patents.

MR. MORRIS: I offer in evidence Belgian patent number 284,885, dated February 4, 1920, as Defendant's Exhibit 113; the translation thereof as 113-A; I offer in evidence as 113-B the certificate of an official of Belgium showing the date

of publication of the Belgian patent; as 113-C a translation of that; 113-D, a Brevet; 113-E, the translation of the Brevet.

MR. WHITCOMB: Counsel for plaintiff objects to the introduction of all those exhibits without exception, on the ground that in this case the patent was not published, and, therefore, does not serve as a printed publication, as do patents in several countries, like the United States, where it is issued and printed right away.

THE COURT: I know, they have some different system there.

MR. WHITCOMB: Yes.

THE COURT: I remember something about that.

MR. WHITCOMB: So again it will be a question of what is patented, and, therefore, you will have to look at the claims again in those patents.

Belgian patent number 284,885, dated February 4, 1920, was marked Defendant's Exhibit number 113.

Translation of Belgian patent number 284,885, dated February 4, 1920, was marked Defendant's Exhibit number 113-A.

Certificate showing date of publication of Belgian patent 284,885 was marked Defendant's Exhibit number 113-B.

Translation of certificate showing date of publication was marked Defendant's Exhibit number 113-C.

Photostat of Brevet, dated 1920, relating to Belgian patent 284,885, was marked Defendant's Exhibit number 113-D.

Translation of Brevet relating to Belgian patent 284,885, was marked Defendant's Exhibit number 113-E.)

MR. MORRIS: Exhibit 113-C, which you have, is by the Ministry of Industry, Labor and Social Affairs, Brussels, General Headquarters, 2nd section—Industrial Property, 1st office, Administrative Service: "I, the undersigned, Maurice CAPART, Director, Chief Official of Industrial Property, declare that the Belgian patent No. 284885 of February 4, 1920, was made public on May 4, 1920, and that the Miscel any of Patents containing a resume of the patent above mentioned was published February 15, 1922. Brussels, the 16th June, 1934." Director, Chief Official, and signed Capart. On the back of the official document is the attestation of the United States Consul.

MR. WHITCOMB: But that refers to just that Brevet that was published.

MR. MORRIS: Oh, no. Here it is—this is not anything (indicating).

MR. WHITCOMB: You can get a printed copy?

MR. MORRIS: All I have got is just what I have got in my hand.

MR. WHITCOMB: What you gave us was typewritten.

MR. MORRIS: True. We had only one official copy, the original. And did we give you a copy of this (indicating)?

MR. WHITCOMB: No.

MR. MORRIS: Well, there they are (tendering).

MR. WHITCOMB: Of course, we registered our objection to all of that. I think we should further object to this certificate as being a conclusion of some officer and no facts are shown to support that.

THE COURT: All right. The objection is noted.

MR. MORRIS: I offer in evidence, as the Defendant's Exhibit 114, the patent to J. M. G. Fullman of March 14, 1916, patent number 1174-975. As 115, I offer in evidence U. S. patent to J. W. Bailey number 846384 of March 5, 1904.

THE COURT: Will you have a file of this prior art for me? Do you have a file of this prior art?

MR. MORRIS: Yes, sir. I will hand it up.

THE COURT: That's all right. I mean, you should have it all together somewhere.

MR. MORRIS: Yes, sir. I will re-assemble one.

THE COURT: All right. Go ahead.

MR. MORRIS: As Defendant's Exhibit No. 116, I offer patent issued to Thibault number 494270. As 116-A, I offer the translation of the Thibault patent, subject, of course, to correction if it should be corrected. As 117, I offer United States patent number 1441168 and, as 118, the patent to Hardinge, 1450289, filed April 29, 1920, and issued April 3, 1923.

Now, just in passing I want to call your Honor's attention to that; there's the mill, and the air is down here (indicating).

As 119, I offer the British patent number 11602 of 1890—that's 119.

As 120,—

MR. WHITCOMB: What was that last one? We didn't get notice of that.

MR. MORRIS: 11602 of 1890.

MR. WHITCOMB: What's the name?

MR. MORRIS: It is Bischof.

MR. WHITCOMB: Oh.

MR. MORRIS: As Defendant's Exhibit 120, I offer in evidence the Canadian patent to Shimadzu, number 243794, dated the 21st day of October, 1924, it having been applied for February 19, 1923, and issued October 21, 1924, which is more than twelve months before the issue of the prior patent '151—applied for more than twelve months prior thereto.

MR. WHITCOMB: As to this patent we wish to make the further objection that we did not receive thirty days' notice of the offer. That's in addition to the other point. Those patents of which we received no notice more than thirty days prior to the offer are admissible only to show the state of the art, and we make the same objection as we did before about the claims.

THE COURT: All right.

MR. MORRIS: All right. I thought it was more than thirty days but, since it is Shimadzu's own patent, I think that does not apply. But that doesn't matter.

But, here's patent '121, the patent to Shimadzu—the patent to Shimadzu, Japanese number 41953—applied for August 29, 1920, issued March 10, 1922.

MR. WHITCOMB: We enter that same objection about the disclosure versus the claims.

MR. MORRIS: I offer in evidence, as our Exhibit 122, a publication by Doctor Lucas in 1917. We have the book and the translation here.

(Discussion off the record.)

MR. MORRIS: I will let you see the book. You know the book?

MR. WHITCOMB: Yes.

MR. MORRIS: So, we will offer that book, the pertinent page of it, as our Exhibit 122.

As 123, we offer in evidence the British patent number 4809 of 1882 to Tatham.

MR. WHITCOMB: We want to enter the same objection about the notice on that last British patent.

MR. SCHAFFER: We didn't have thirty days' notice.

MR. WHITCOMB: I will have a standing objection on that?

THE COURT: Yes.

MR. MORRIS: As the defendant's Exhibit 122-A, I offer a translation of Doctor Lucas book of 1917, with respect to the pertinent page. Will your Honor pardon me just a moment?

The witness, resuming, testified: Taking your file, I will compare the exhibits which have just been offered in evidence of the patents and the article by Dr. Lucas with the patents or the process of the patents in suit. The first patent referred to is Exhibit

number 111, the Japanese Patent No. 41728. I have already explained about that. Belgian Patent Nos. 284885, Exhibit number 113, issued to the Tudor Accumulateurs, which is the Tudor Storage Battery Company, in France, describes a method for producing lead powder by putting balls of lead into a metallic rotating drum perforated with holes, by the rotation of the drum—by the rotation of the drum the balls rub on one another, and there is produced a fine powder of the metal which, passing through the holes in the drum, can be collected on the outside.

The patent or the process further states that, with the help primarily of the heat liberated by the friction of the balls and also as a consequence of the air in the rotating of the drum, the particles of lead powder detached from the balls undergo the beginning of oxidation, and it is possible to control this oxidation by changing the volume of the balls, or by varying the revolutions of the drum or, finally, by making a supplemental entrance of air in the casing. In other words, by controlling the supply of air.

The process can be so controlled as to produce either metallic lead powder or any—or any of the oxides of lead powder. For example, it is said that if it is desired to delay the transformation of the lead powder into oxide, it is sufficient to plug up all of the entrances for air into the apparatus and store up the lead powder in the metallic state. It is possible, subsequently, to transform this lead powder into such or such oxide of lead at the desired moment by submitting it to an action, more or less active, of the oxygen of the air.

I believe that this process, as disclosed in this patent, corresponds exactly with the processes described in the patents in suit,—'149 which refers to

lead powder, and '150 which refers to an oxidized powder of lead—and, while the Belgian patent does not specifically refer to lead suboxide, the testimony of the experts that have testified in this case shows that any oxidation of lead must pass through the suboxide stage, if that testimony is correct.

The Belgian patent discloses the control of the supply of air, which is also mentioned in certain of the patents in suit.

I believe that covers the comparison of that patent with the patents in suit.

The next one that was mentioned was Fullman Patent 1,174,975, Exhibit 114. The patent to Fullman discloses a rotating drum, perforated with holes, with an air pipe extending into the interior of the drum having jets from which air, under pressure, may be discharged into the interior of the drum. This apparatus is described as applied for grinding or abrading materials and for blowing the material thus abrased out of the drum by means of the jet of air. On page two, line thirty-eight, It describes the second form in which the jets of air are introduced into the inside of the drum:

> "... In this form the streams of air, instead of being directed from outside into the barrel, are released from within the barrel and play directly upon the articles under treatment."

The treatment is for abrading oxidized particles from the surface of the metal. I think I have no further comment with respect to Fullman.

Comparing it with the patents in suit, 149, 150 and 151, in '149 a similar step in the process is dis-

closed. At the bottom of the first column on page one,

> ". . . within this cylinder is fitted an air blower provided with small holes."

And in the second column, line sixty-seven,

> ". . . air blast having a pressure of 2.5 pounds per square inch is sent out of the air blower."

This description corresponds exactly with the disclosure in the Fullman patent.

In patent '150, on page two, line ten, the statement is made:

> ". . . that any such oxidizing agent may be blown into the cylinder in a gust, or may cause the cylinder to suck it. If it is blown into it, it is convenient to utilize the force of the current thus caused to blow the powder formed out of the cylinder and then collect it."

That reference indicates that blowing the powder out of the cylinder is a matter of convenience but not a necessary step in the process.

In patent '151, the same step is disclosed on page one, line thirty—or, line twenty-nine—where it refers to blowing the air into the drum all the while.

I don't find in '479 a direct reference to a blower, although it does refer to the introduction of air into the drum.

Mr. Morris: I inadvertently, in assembling from the mass of the prior art this morning, omitted British Patent number 13202, of 1898.

which refers to the British Patent 11602, of 1890, which I did put in evidence.

MR. WHITCOMB: We want to make the objection that the exhibit 119, the British Patent 11602 of 1890, was never cited in the answer or in the answer to the bill of particulars.

THE COURT: All right, I will note the objection

MR. MORRIS: But 13202 of 1898 was, and I am now offering as Exhibit 124 number 13202.

MR. KWIS: Of what year?

MR. MORRIS: Of 1898.

(Photostat of British Patent 13,202, of 1898, was marked Defendant's Exhibit number 124.)

MR. MORRIS: And the opinion of the C. C. P. A. in the Interference is reported in 59 Federal Second 225. It always seems strange to me to offer an opinion, but I find in certain cases an opinion should be offered as constituting part of the record.

THE COURT: Is that so? I never heard of it.

MR. MORRIS: It came as a great deal of surprise to me, when I first heard of it myself.

THE COURT: I am sure the stenographer won't object.

MR. MORRIS: No, I don't want it read into the record.

THE COURT: Oh.

MR. MORRIS: I am just offering it without really putting in a copy, because it is always in

the Federal, so I am offering as Exhibit 125 the opinion of the C. C. P. A., in the Hall-Shimadzu Interference cases, which opinion is reported in 59 Federal Second 225, and I ask that it be not even included among the physical exhibits, because it is available in 59 Federal Second.

MR. WHITCOMB: We agree.

The witness, resuming, testified: I think I had finished Fullman.

The next patent is the exhibit, Defendant's Exhibit number 115, issued to John W. Bailey, United States Patent number 846,384, dated March 5, 1907. This patent discloses a process for producing lead powder in a stationary chamber in which are located a number of so-called beaters, these beaters being somewhat like squirrel cage devices, which are revolved at sufficiently high velocity to produce the desired results. Into this chamber is introduced lead in the form of coarse powder, coarse grained powder, and by contact with the revolving beaters it is reduced to a fine, impalpable powder.

This is Bailey, 846,384. There are two Bailey patents. I would say that that is similar to this process because the Bailey process, the preferred embodiment states, at the top of page two: "While this process of producing the new product is preferred, it is possible that the product may be produced in other ways, as by a grinding or abrading process." The raw material is in the form of a coarse grained powder and it is reduced. It seems to me that that language at the top of page two would naturally suggest what was very well known at that time, the ordinary ball mill. At the bottom of the first column of page 1 he states:

> "I have discovered that the metallic lead may be reduced to the form of a dust or an impalpable and practically amorphous powder and that when it is subjected to chemical action in this condition it is rapidly and uniformly transformed into the ordinary lead pigments and other compounds, such as white lead, litharge, or red lead."

That in my opinion discloses the product of the patents in suit, especially when you refer to line 11—line 9, on page 2, where it says:

> "The new product may be substantially pure metal or it may be a mixture of the metal and an oxide thereof. It has a dark gray color."

and so on, and the reference to the powder being in the form, the product being in the form of an impalpable powder would in my opinion be the equivalent of the fine powder referred to in the patents in suit.

Also, where he says on page 1, line 15, he produces the metal in a form which greatly facilitates its chemical union with other substances, it refers very definitely to high chemical reactivity.

Then at the bottom, on page 2, at the bottom of the second column, he states:

> "For the purpose of discharging the pulverized lead from the chamber when it has reached a suitable degree of fineness the casing is provided with a discharge-opening 56, which is preferably arranged at or near the top of the chamber, and said opening is connected by a pipe or passage 57 to the suction port of an exhaust fan or blower 58. The delivery-passage 59 of

the fan 58 may be connected to a suitable collecting-chamber in the ordinary manner. Any other suitable means may be provided for maintaining a current of air through the pulverizing-chamber."

Then on the top, in the first column, page 3:

"It follows from this construction that all of the lead introduced into the pulverizing-chamber will be kept in a state of rapid motion and will be continually coming in contact with oppositely-moving parts or particles, whereby it will be rapidly and efficiently reduced to a powder and will not be delivered from the casing until it has been reduced to a fine state, such that it may be conveyed in opposition to the force of gravity by the current of air produced by the fan. By regulating the speed of the fan, therefore, and the consequent velocity of the current of air the degree of fineness of the metal delivered from the pulverizing-chamber may be nicely controlled. The velocity of the current of air, however, will be made so moderate as not to convey the lead out of the pulverizing-chamber until it has been reduced to an impalpable powder."

We find, therefore, in this description the pulverizing process by abrasion, we find the introduction of a current of air, we find the current of air carrying the powder out of the vessel, we find the current of air controlled to produce the desired results.

In reference to the use of a coarse grained powder as referred to I would refer to Shimadzu's Japanese patent number 60825, and to page 1 of the translation, paragraph two.

MR. WHITCOMB: By the way, Your Honor, counsel for the Plaintiff would like to offer in evidence this particular Japanese patent, and asks the clerk to mark the same—I assume that you were not going to introduce it—61.

(Discussion off the record.)

MR. WHITCOMB: We can agree on the one to use, because it is the one that has been exchanged between counsel before trial.

(Shimadzu Patent number 60825 was marked Plaintiffs' Exhibit number 61.)

The witness, resuming, testified: At that point the Japanese patent states that the process—in the process lumps of metallic lead or a coarse powder may be placed inside the rotating vessel. It would appear, therefore, that the use by Bailey of a coarse powder rather than lumps of lead is quite equivalent to the lumps of lead referred to in some of the patents in suit.

The next patent referred to is Defendant's Exhibit number 116, French Patent number 494,270, to Thibault, filed December 30, 1918, and published September 4, 1919. This patent is substantially identical with the United States patent to the same inventor, but carries a somewhat earlier date. This patent to Thibault discloses a process for producing oxides of lead, including litharge, minium, or red lead, by introducing into a rotating drum pieces of lead and a current of air, and rotating the drum, abrading the pieces of lead, and continuing the oxidizing action of the air until the entire contents of the drum is converted into litharge.

This patent refers to the introduction of a certain amount of water vapor into the current of air,

but at the bottom of the second page of the translation: the last paragraph, the statement is made that the transformation is brought about by the simple current of air, as in the other processes, but the fact of accomplishing this reaction in the presence of water vapor favors greatly the action of the oxidizing agents and makes it possible to shorten the operation. It is quite evident from that that the introduction of water vapor has no effect on the product except to hasten the operation, and the result can be obtained without the introduction of water vapor.

The diagram of the apparatus shows a valve at the exit from the chamber "A", which is used to control the stream of air. The air itself is heated in a coil before it enters the chamber, the coil being shown at "E". It appears, therefore, that we have a controlled stream of air and a revolving drum in which pieces of lead are caused to abrade against each other, and are caused to be oxidized until a final product of litharge is produced.

Now, while it is true that the final product sought in this process is litharge, it is shown that it takes about six hours to convert the entire mass into litharge, and, of course, at some earlier stage there must have been a partial conversion of the material into lead oxide, showing that in the early stage—Litharge is lead oxide, but only part of it was converted in the earlier stages of the operation, since it took six hours to convert it all. So that in the earlier stages we would have a product corresponding to the partially oridized products of the patents in suit. I think a partially oxidized product is a mixture of lead and monoxide.

The next patent referred to is Defendant's Exhibit number 117, U. S. Patent 1,441,168 to Peters,

issued January 2nd, 1923, filed June 5th, 1922. This discloses a process of producing lead suboxide, Pb_2O, and the product contains also some oxide of lead, PbO, as shown on lines 13 and 14. It describes the product in line 21 and following in these terms:

> "The suboxide of lead is a dark greyish fine powder which when heated in air burns with a yellow flame to oxide of lead."

That in my opinion discloses the process of patent 151, which covers a process for converting lead suboxide into litharge by the initial application of heat, the process being continued by the heat of the reaction. This gentleman gets his lead suboxide very easily. In the last sentence on the first column it states:

> "If the process is properly carried out the suboxide of lead is predominant in the product."

The next reference is exhibit, Defendant's Exhibit number 118, U. S. Patent 1,450,289, to Hardinge. This shows the Hardinge Mill of the structure similar to that of the Defendant, but in addition it shows the introduction of a blast of air into the mill for carrying out the fine product. The patent itself describes very clearly the classifying action of the Hardinge Mill, whereby the fine part of the product gravitates toward the outlet.

I will take up next British Patent 11,602, Defendant's Exhibit 119; this patent number 11,602, of 1890, to Bischof, describes a process for producing lead suboxide, Pb_2O. He starts with a higher oxide and reduces. He starts with the higher oxides and blows hydrogen gas on them. It is a disclosure of Pb_2O.

THE COURT: Is the Canadian Patent the same as one of our patents?

MR. MORRIS: 151.

THE COURT: It is identically the same?

MR. MORRIS: The claims are not in the same language,—

THE COURT: All right.

MR. MORRIS: — but the specification is in almost identical language, and the claims, I think, quite similar, substantially—

The witness, resuming, testified: I would like to add a word in regard to this Bischof Patent, which I omitted to mention, where he says in line 25: "I hydrate and oxidize it by slaking it with water and exposing it to the air, the suboxide being thus converted into a higher oxide, probably monoxide." It seems there that he is disclosing the process of oxidizing this suboxide, either by exposure to air or by treatment with water, as disclosed in the Plaintiffs' Patent number 151.

I understand that it is not necessary for me to compare in detail this Canadian Patent with the corresponding United States Patent. Its language is practically identical. I say that the specification and description in the Canadian patent is almost word for word with the patent 151 in suit. I believe that is true.

The next patent referred to is Japanese Patent 41,953, Defendant's Exhibit number 121. The oath in the United States Patent 151 states that no foreign application for said improvement—applications for said improvements have been filed except Japan, August 29, 1920. This Japanese application resulted

in Japanese Patent 41,953, which is Defendant's Exhibit number 121, and this patent discloses a process for producing litharge by the initial application of heat to fine lead powder produced by mechanical grinding or rubbing together lumps of lead. The U. E. application, which is stated to cover the same invention as the Japanese application, the powder converted into litharge, is stated to be lead suboxide intermingled with metallic lead powder. It is evident, then, from those statements that the fine powder of metallic—of lead—fine lead powder referred in the Japanese application is identical with the lead suboxide referred to in the United States application. Now, if this is true, then the lead powder and the process of making it referred to in Japanese patent 41,728, 42,562, and 42,563 are the same process and product as those set forth in United States patent 150. The United States patent 150 was applied for more than a year later than the Japanese applications and was issued earlier—and was issued later.

In further reference to 41,953 the process described consists in subjecting lead powder to the air, and when exposed to the air it is oxidized by the oxygen of the air and because of the heat of reaction a spontaneous reaction goes on and changes the powder to litharge. That, of course, is the same process as described in 151.

I believe that is all.

There is a reference to Dr. Lucas' book. The German book by Dr. Lucas, which was published in 1917, has on page 24 a reference to the use of lead dust in the manufacture of storage battery plates. I will read the translation of the two paragraphs on this page:

"The production of the active layer takes place either by the process of Faure by pasting into the lead grids litharge or red lead, or a mixture of both, or even white lead, or lead dust"—the German word for which is "Bleistaub"—"produced by abrading or pulverizing lead; or by forming a layer of lead-sulphate or lead peroxide out of the surface of the grids or plates by means of the electric current by the original Plante process.

"The lead oxides or salts are stirred with caustic potash or glycerine or sulpuric acid, or mixtures thereof, to which also perhaps many a resin or alcohol is added, into a stiff paste which either by hand or by machines is pasted into the grids and electrolytically reduced or oxidized."

The rest is not of any important bearing. Now, this discloses the use of the powder which was known at that time in Germany as Bleistaub, and was the product of the German mills produced by abrading or pulverizing lead balls in the presence of air.

Mr. Whitcomb: It seems to me that is objectionable. He is talking about what actually transpired.

Mr. Morris: He hasn't finished. I assume that he means testified to in this case.

The Witness: That has been testified to by Mr. Smith.

Mr. Whitcomb: Well, it is objectionable as to what transpired in a foreign country, then, too.

Mr. Morris: I do not understand Dr. Wood-

bridge's testimony to be as to a matter of fact as to what did happen in Germany, but I understand him to be directing his testimony at the moment to the definition of Bleistaub, which has been shown by Mr. Smith to be the product of the German mills abroad and the German mill as used by the defendant in Philadelphia. I think that—

THE WITNESS: That is what I am intending to state.

THE COURT: All right. I will note the objection. Go ahead.

THE WITNESS: And this word "Bleistaub" is the same word that is used by the plaintiff, Shimadzu, in his German patent to describe his product. Therefore, it seems perfectly obvious that this publication discloses the use of that material in the manufacture of paste for storage battery plates.

The next patent, Defendant's Exhibit 123, is British Patent to Tatham, 4809 of 1882.

This patent discloses the use of lead suboxide in the paste of storage battery plates. He refers to mixing the powder with paper pulp, and is described more particularly in lines 39 and following of the complete specification, which reads as follows:

"Paper pulp prepared from unsized paper, cotton, linen rags or other vegetable fibre is mixed when moist with twelve times its volume of peroxide of lead for the positive element or anode and with a similar quantity by volume of suboxide of lead for the negative element or

cathode so that the mixture or compound contains about 93 per cent. by volume of the metallic or active agent."

That, I believe, discloses the use of suboxide of lead in the paste of storage battery plates.

Was that the last reference patent?

I will now take up British Patent to Bischof, 13,202 of 1898, which is Defendant's Exhibit 124. This patent discloses apparatus for the production of Pb_2O, and refers to the process disclosed in specification 11,602 of 1890. The process itself for producing the suboxide consists in reducing the higher oxides to suboxide, but I believe I have explained that in connection with 11,602.

I don't find that reference to the conversion of suboxide into PbO by heat, by the heat of reaction, which is given in the other patent. There is a reference to cooling the product Pb_2O as it descends through the passage, which would, of course, indicate that it is necessary to do this in order to prevent its further oxidation.

Now, Dr. Woodbridge, will you be good enough to turn to the abandoned application of Shimadzu, number 431,473, filed December ., 1920, and compare and point out its similarities, if any, and differences, if any, to the disclosures of patents 150, 151, 152, in suit?

A. 152 isn't in, is it?

Q. I don't know whether 152 is in suit or not.

Mr. Morris: I wonder if we can inquire, is 152 in suit here?

Mr. Schaffer: We have given notice that we are not relying on any of the claims.

Mr. Kwis: You have given notice.

MR. MORRIS: I didn't know.

MR. SCHAFFER: Yes.

MR. STOUGHTON: 152 is out.

MR. MORRIS: 152 is out; I didn't know that.

(The witness resuming testified):

This abandoned application describes a process for converting finely divided lead powder into the higher oxides. It does not refer in any way to the method of producing the fine lead powder. It does not refer to a rotating drum. It does say, "I pulverize metallic lead by mechanical means into fine powder". That, I believe, is the only reference to any process of producing the fine powder, and it then discloses the subject of igniting this powder and continuing the reaction by the heat of reaction until the entire mass is converted into litharge.

I do not find any reference to suboxide, any reference to putting balls of lead into a revolving drum, I do not find any references to introducing a current of air or controlling any such current of air, or controlling the temperature for the production of this powder, and apparently the only step in the process disclosed is the further oxidation of finely divided lead powder by the initial ignition of the powder and continuing the reaction by the heat of reaction.

It does state at the bottom of page three:

> "It is also necessary that fresh lead powder be employed, as suboxidized lead is less active than pure lead."

I believe that is the only place where the word

"suboxidized lead" is mentioned and it appears to be excluded from the process described.

Cross-examination.

By Mr. Whitcomb:

I think I have not found that term "suboxide" in any patents where I haven't mentioned it.

Q. And that applies to the Japanese patent 41,728, the Japanese patent 42,563, your exhibits 111 and 112. The Fullman patent, your Exhibit 114, does not mention lead at all, does it?

A. No.

The Bailey patent, our Exhibit 115, does not mention suboxide. The French patent to Thibault does not mention suboxide. I don't recall very distinctly the prosecution of the Hall application by Mr. Stoughton; I may have had some information. I don't think our company owned the Hall application. I believe we were operating under the Hall patent. Mr. Hall is an employee of the company and Mr. Stoughton prosecuted the patent application in interference and I believe represents both parties. I am not very familiar with the statement of Mr. Stoughton's with respect to the Thibault patent in the file wrapper, Plaintiffs' Exhibit 18, of the Hall patent, 1,888,823, where he says: "therefore these claims"—and he is referring to the claims of the Interference, some of the claims now involved in this suit—"differentiate from Thibault who has two oxidizing gases, air and steam. The steam acts as a catalyst in the presence of applied heat producing lead hydrate which in the presence of heat and air goes to litharge. With superheated steam and air and without applied heat the reaction would not start until the mill got full of water and then it would be

a wet process. It apparently not only requires applied heat but also pressure to get a reaction with air and superheated steam. The real limitation in the claims under discussion is that a single oxidizing gas, air, produces an entirely different result from the two oxidizing gases of Thibault."? I would like to read it over rather carefully before expressing an opinion. (The file wrapper was shown to the witness.)

I do not entirely agree with this opinion of Mr. Stoughton's. In the first place, it appears to be limited to the preferred process of Thibault, in which he introduces steam, and does not refer to Thibault's alternative, in which steam is omitted. There is a question in my mind whether the reaction would not start with superheated steam and air and without applied heat, but I don't know that that has any bearing on the case. You could hardly get superheated steam and air without a rise of temperature.

Referring to the Belgian Tudor patent, Exhibit 113, I believe that no temperature limits are given there. I believe there is no forced draft mentioned there, no fan illustrated or described. Moreover, he says that he can operate with or without air. I would take that to mean that he can get any range of oxidation that he wants, and even down to metallic powder, as he claims, by controlling the amount of air down to the point of excluding air. I think he probably was mistaken in supposing that he could get a product without any air at all. I don't think he could get the metallic powder without air. Metal powder can be broader than a powder composed exclusively and solely of metallic lead. In line three of the second paragraph he says he is producing a powder of the metal—"Fine powder of the metal".

I think he probably means the same thing that is implied in the '149 patent of Shimadzu and in the Japanese patent corresponding. This is the Tudor Belgian Brevet. This was translated by Professor Hopkins in Lafayette College.

Turning to page 2 of the translation of the Belgian main patent, it is stated: "It will then be possible to transform this lead powder, whenever desired into one or the other oxide of lead, by submitting it to a greater or less activity of the oxygen and the air."

I think that it is quite clear as to just what this language taken in connection with the entire description actually means. He can by restricting the air produce, as he claims, a metallic lead powder, he evidently thought that he could, and that if he does produce that lead powder he can store it up and later convert it into any of the lead oxides, but if he does not exclude the air from his mill he can produce directly in the mill any oxide that he wants. That is, take this statement, about the second paragraph above the one to which you referred: "thus by these methods of reaction the whole range of lead oxides will be obtained". That is, it comes before he refers to getting a pure lead powder, and then transforming it into a higher oxide.

Q. But, in any event, when he describes the admission of air he talks about its admission and control of its admission to the casing and not into the drum where the balls are, isn't that correct?

A. I don't see the place that you refer to, where you speak of stopping the entrance of air into the casing.

Q. The word "casing" appears—

A. Yes.

Q. — in the last line—

A. Yes.

Q. — of the middle paragraph on the first page.

A. That indicates that he can provide an additional supply of air to that which was provided for in the earlier part of the description, by making a supplementary entrance of air into the casing.

Q. Well, is there any reference to any air getting into the drum except that that was present with the drum when it was started, so that the powder can get this very initial oxidation that you referred to on your direct testimony?

A. He refers to the air present in the rotating drum. That does not necessarily limit it to the air that is there initially,—

Q. But when he refers—

A. — without any further admission.

Q. — to any additional air, he merely says that he will supply it to the casing, isn't that correct? If not, point out where he says he supplies it anywhere else.

This supplementary entrance of air is supplied to the casing, but, of course, it enters the drum through the holes that are described, which perforate the drum all the way around.

There is no stack mentioned. There is no drawing. There could, course, be no supplementary entrance of air in the casing unless there were some way for it to escape, it would finally create an enormous pressure. I heard Mr. Smith testify that in practice without the stack the air leaked out through the cracks and so forth. I don't disagree with him, I am just agreeing with him. I am not pointing out that there would have to be a stack. I am pointing out that there would have to be some exit for the air that is provided by this supplementary entrance,

to get out of the whole apparatus. That is not pointed out anywhere in the patent. There is no mention of that. I don't find any reference in this Belgian patent, direct reference to temperature, nor to speed of rotation.

Q. Moreover, doesn't he say toward the end of the patent, third paragraph from the end, I believe, counting that little paragraph, that it is obvious that the same results could be secured by using mechanical means, for example, a shaking table, is that right?

A. What paragraph—yes, in the paragraph at the top of the last page.

Q. Yes.

A. Or haven't you the same?

Q. Yes.

A. Yes, he refers to a shaking table.

Q. You referred to the U. S. Peters patent, 1,441,668, and I didn't understand whether you claim that suboxide could have been made or could not have been made at the date of that patent. What is your position?

A. My personal opinion is that there is no such thing as suboxide of lead.

Q. Then how could you say that that patent discloses suboxide of lead and anticipates any of the patents in suit.

A. Well, of course, if my personal opinion is going to rule, then there wouldn't be any suboxide of lead in the patents in suit.

Hall has been in the room witnessing the proceeding a good deal of the time I believe ever since we have been here and defendant opened its case. I knew Hall was trying to get an application for patent and had these interference proceedings. At that time I was very doubtful of there being suboxide of lead as a definite chemical compound.

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Re-direct-examination.

By Mr. Morris:

I was of opinion that Hall had made at times such a product as was described according to its physical properties in the Shimadzu patent.

Q. Are you now speaking of the gray oxide, which is the product of Defendant's mills, or of some of the other products made by Hall's mill?

A. I am speaking of some of the other products made by Hall's mill which had those characteristics. Hall had made oxides of lead which were chemically reactive. So much so that they were spontaneously converted into litharge by a mere exposing to air. I am referring to other oxides that he made and not to his gray oxide. The kind of oxide that would be converted into litharge on exposure to air would be a powder that contained much less proportion of oxide than the gray oxide contains, and much more of the highly reactive lead powder. At that time there was very considerable disagreement on the part of authorities as to what that dark powder actually was.

Many thought it was suboxide, and others thought that it was metallic lead and litharge, and later investigations have shown that it is metallic lead and litharge, and does not contain suboxide, and that the highly reactive characteristic is due to the large proportion of the metallic lead. Turning now to the abandoned application of Shimadzu, it states: "It is also necessary that fresh lead powder be employed, as suboxidized lead is less active than pure lead". At the bottom of the first column of patent '150, the sentence beginning at line 54 and continuing through two or three lines reads: "It is a porous mass of amorphous particles and although not very much different in its property from metallic lead, it is so

chemically reactive that it is spontaneously converted into litharge by merely exposing it to air. If a drop of water is dropped—"

Mr. Morris: No, that is far enough. The point of tnat, if I can make it clear, so that our case wi l appear, is this, that is, the metallic lead, unoxidized metallic lead, is pyrophoric, and will take fire if you toss it in the air, because it has affinity for lead, which has not been satisfied.

The Court: For air, for oxygen.

Mr. Morris: For oxygen, thank you; provided the particles are small enough. To my mind I compare it with the shavings of a white pine board, put a match to them and they will go like that (indicating), but you can hold a match to the board for a long time and get no result.

Now, the more, let's call it PbO, that we have in a mixture, and the distribution of the lead and the PbO is one way, suppose the lead is on the outside, with the PbO as a core, then you have a mixture of metallic lead and PbO, where the metallic lead is the thing that is exposed to the air, and consequently it is highly reactive. Now, the more PbO you have in that mixture the less reactive it becomes, assuming the physical distribution of the two elements is the same, and we do not disagree with the plaintiff on that, because he says in his abandoned application that it is highly reactive metallic lead, and then he says his Pb_2O is not much different, but slightly less reactive, and the thought about the Hall application, as is shown without reading it as a whole, by the Interference record, is that the

matter that was there involved was not gray oxide at all, which is here involved, but was these lower oxides that meet the requirements of 150, and if that was Pb_2O for Shimadzu, it was Pb_2O for any other man who had made that same product.

THE COURT: Yes, I understand that, but, you see, the point as I really stopped the plaintiff from examining about the Hall application, or from cross-examining, I mean, about the Hall application. The only thing that got in the case was, namely, the question whether at a certain period of time, namely, the time when Hall made his application, Dr. Woodbridge was of the same opinion as he is now as to the existence of Pb_2O, and he says at that time he was doubtful. Now, that is really all there is in this testimony to examine about. I don't think there is any occasion now for going into the Hall application. There may be later on.

By THE COURT:

Q. Did you want to say something?

A. I just wanted to add one word in regard to my present opinion.

Q. Yes.

A. That is, my present opinion in regard to the non-existence of suboxide of lead has been very much strengthened after hearing the evidence in this case, than it was at the time of the Hall—

By MR. MORRIS:

Q. And by conferences with certain of the other witnesses that are to be called?

A. Yes.

Witness excused.

WHEELER P. DAVEY, was called as an expert witness on behalf of defendant and having been first duly sworn, testified as follows:

Direct-examination.

By MR. MORRIS:

My residence is State College, Pennsylvania. My occupation is Research Professor of Physics and Chemistry. I have had graduate training in physics with a Master's Degree at Pennsylvania State College; Ph. D. in physics at Cornell University; thirteen years as research physicist and what turned out to be physicist-chemist, but it wasn't known as that in those days, for the Research Laboratory of the General Electric Company. I was with the General Electric as research physicist for about thirteen years. I first started working with X-rays in the fall of 1909.

Q. Are you able to tell me, Dr. Davey, whether materials can be identified by X-ray diffraction methods and, if so, will you tell me how?

A. The X-ray diffraction pattern of a pure crystalline substance is definitely characteristic of that material. The ability to produce that characteristic diffraction pattern is just as much a fundamental property of a pure crystalline substance as is its density, its boiling point, or its melting point, and it is just as useful as a means of identification.

In speaking of a definite characteristic diffraction pattern in this way, I wish to be understood as referring not only to the relative intensities of the various lines in the pattern but also to the definite value of the interplaner spacings—

MR. WHITCOMB: Our colleague, Dr. Clark,

wants to call attention to the fact that the witness is just reading.

By Mr. Morris:

Q. What is it you are reading from, Dr. Davey?

A. My own handwriting, notes in my own handwriting.

Q. And you are using the notes for what purpose?

A. For the sake of making the record accurate, as accurate as possible.

Q. And as long as possible?

A. No, as short as possible.

The Court: All right. It's all right. I have no objection.

The Witness: I can do it without the notes, if the Court pleases, but it will take longer and the transcript record may not be quite as clear.

The Court: It doesn't matter to me.

By Mr. Morris:

Q. I haven't seen those notes, have I?

A. You have never seen those notes. I wrote them out for my own convenience.

Q. Very well. Proceed.

A. If a crystal analyist is asked to identify a specimen of a pure crystalline material, he first—

The Court: The only thing is when you read it—all right, go ahead.

The Witness: If a crystal analyst is asked to identify a specimen of a pure crystalline material, he first determines the type of diffraction pattern from this material and then compares

this pattern with patterns of the same type made from standard materials which have been previously chemically identified. When he finds a standard diffraction pattern which exactly matches the pattern of his specimen, he has identified that specimen.

The crystal analyst is, in his work, in much the same position as a fingerprint expert. When a fingerprint expert is handed a fingerprint and is asked who the person is who made it, he must first determine the type of fingerprint and, then search through his files and the files of others in order to find the fingerprint of some known person whose prints will exactly match those which have been submitted to him. If he can find a set of standard fingerprints which exactly match those submitted to him, he has positively identified the person who made the prints. If no exact match can be found, the only way the fingerprint expert can identify his man is to take, systematically, the fingerprints of every one in the world who has not yet been fingerprinted until he finally stumbles upon the correct man.

Similarly, if the crystal analyst can find no exact match he must, in order to identify his unknown specimen by means of its X-ray diffraction pattern, take, systematically, diffraction patterns of known pure, crystalline materials until he finally happens upon the substance which gives an exact match. Then, and not until then, has he identified the unknown specimen.

In the case of the so-called Pb_2O, there is no standard diffraction pattern on record. Two attempts have been made to establish such a

standard pattern—one published by Ferrari and one given in this Court by Dr. Clark. Ferrari made some material of some sort in accordance with a recipe which was reputed to give Pb_2O_4. The recipe is in considerable disrepute in many quarters, but Ferrari apparently had an implicit faith in the recipe for he has made no record of an adequate chemical analysis for establishing the identity of his product.

It is my understanding that Ferrari was never able to make but one batch of this product and, from this single batch, he was able to take only a single diffraction pattern of the type which he reported as due to the so-called Pb_2O. He records that his so-called Pb_2O must have been unstable for he could not duplicate his original diffraction pattern. So, Ferrari's diffraction pattern, evidently, deals with a substance which he has not been able to duplicate and which he never really identified chemically.

On this ground alone, it cannot be set up as a comparison standard. In addition, the internal evidence of his X-ray diffraction data, as published, indicated a precision of measurement far too low for a comparison standard if that standard is assumed to have a cuprite structure as Dr. Clark has stated it has—

THE COURT: Wait a minute. I am losing track of that. You will have to read that over again.

THE WITNESS: Am I going too fast?

THE COURT: I am going too slow, I guess.

MR. MORRIS: I wish you would go a little slower for us.

THE COURT: It's all right for me, but I want you to read that last again.

THE WITNESS: In addition, the internal evidence of the X-ray diffraction data, as published, indicated a precision of measurement far too low for a comparison standard—

By THE COURT:

Q. You mean it was too slovenly a measurement?

A. Possibly not too slovenly. It may have been that he had a very massy diffraction pattern and couldn't measure it very accurately.

Q. What do you mean by a too low precision?

A. I mean that the evidence—

Q. You mean it was not precise?

A. This difficulty: Measurements of the interplaner spacings—

Q. Those are the lines?

A. Yes. He couldn't locate his lines accurately enough, if we assume that this standard is to have a cuprite structure. I will show evidence later—

Q. If you assume—

A. If you assume that Ferrari had, as he claimed he had, a cuprite structure, the match—

Q. Then his lines were not accurately enough located?

A. His lines were not accurately located. The match between the lines he recorded and the pattern which he should have had, for a face-centered cubic type is very poor. Does that make the statement plain?

Q. Maybe I am just—well, I don't see—if he didn't have enough precision for one purpose, I would think he wouldn't have enough precision for any purpose. You say he didn't have enough pre-

cision if you assume he had a cuprite structure. I don't see why it was conditional at all there.

A. Yes. On Ferrari's photographic film, he had two diffraction patterns—

Q. Yes.

A. —and one was metallic lead, the other was this so-called Pb_2O. The diffraction pattern for metallic lead is pretty well known, and the match which you could get between that true lead pattern and the pattern which Ferrari got for his lead wasn't too good. Ferrari also claimed that his Pb_2O, so-called, had a cuprite structure. He made the same claim for it that Dr. Clark made in his original testimony.

Now, if that Pb_2O had a cuprite structure, there must be certain definite, mathematical relationships between the lines in his pattern. Those lines in Ferrari's pattern do not match those mathematical relationships, except if you are willing to grant the rather coarse approximations in his measurements.

Q. All right.

A. Does that make it plain?

Q. Yes. I think you had better go ahead. I don't want to get you off the track.

A. Don't you worry about that.

By Mr. Morris:

Q. Suppose you proceed, and then we will come back to the cuprite structure later.

A. Clark also made some material of some sort using the same general recipe followed by Ferrari—

Q. A little slower please, Mr. Davey.

A. Clark also made some material of this sort, using the same recipe that was followed by Ferrari.

By The Court:

Q. That was his oxalate?

A. Oxalate—Pb_2O.

Q. That was the recipe that Ferrari used?

A. Yes.

The Court: All right.

The Witness: Clark has admitted to this Court that he had no qualitative test for so-called Pb_2O, and that his quantitative analysis was not capable of distinguishing between his so-called Pb_2O and the well-known PbO for the sample he had at his disposal.

Now, as Dr. Clark is a professor in the Chemistry Department of the University of Illinois, and a reputable chemist, and in charge of the courses in analysis, analytical chemistry, there, I assume that his statement is quite sufficient in this regard, so that we can assume that he had a chemically unidentified specimen.

By The Court:

Q. Now, is that in his oxalate experiment?

A. Oxalate oxide—for that he had no chemical analysis.

Q. Yes. But that was only one possible experiment? That was only one of his experiments, wasn't it; that was a sort of confirmatory experiment, I understood it. He took a planned oxide—Exide oxide—wasn't that chemically identified?

A. No.

Q. All right. Your statement is he never made any experiment on a chemically identified substance?

A. Correct. The closest he came to it was in the case of this super-centrifuge sample, where he tested

for lead, out of a total of one-tenth of a gram—that's a thirtieth of an ounce—and he has testified, if I remember correctly, that that analysis was not complete enough to enable him to distinguish between Pb_2O and PbO.

By Mr. Morris:

Q. You said one-thirtieth of an ounce. Wasn't it one-tenth of a gram, and wouldn't that be one-three-hundredth?

A. Excuse me. Yes, that would be one-three-hundredth.

Q. A little more, wouldn't it?

A. About two eighty. Yes, about two eighty.

Q. Yes.

A. He has tried to overcome this defect by trying to show, in his original direct testimony, that his data are at least consistent with the guess that his material was really Pb_2O and that it had a true cuprite srucure.

Such a method of overcoming the lack of a knowledge of the chemical identity of his standard substance involves the error in logic illustrated by the following syllogism: This horse is a quadruped; therefore all quadrupeds are horses.

By The Court:

Q. What do you mean by standard substance, the—

A. The thing which would correspond to the fingerprint in the fingerprint expert's files.

Mr. Whitcomb: Your Honor, is this harangue against Dr. Clark or his testimony in this case?

Mr. Morris: Not against Dr. Clark at all; just against his testimony.

THE COURT: Yes: It is certainly designed to show that Dr. Clark's testimony is of no value whatever to this Court.

THE WITNESS: Dr. Clark and I have been friends—

THE COURT: Yes.

THE WITNESS: — for a great many years. I have known him ever since he was a graduate student.

MR. MORRIS: Will you proceed to deal with his testimony, then, Dr. Davey?

THE COURT: All right, go ahead.

By MR. MORRIS:

Q. May I see if I understood you at one place there, about the chemical analyses testified to by Dr. Clark? Were you dealing with his Berzelius product there or not? Just what was the boundary of what you understood that Dr. Clark had no chemical analysis for? I just mean, your testimony.

THE COURT: He very broadly said he didn't have any chemical analysis for anything he put the X-ray test to, is that right?

THE WITNESS: He had no chemical analysis for the composition of his so-called Pb_2O in any of his experiments.

THE COURT: No, no. No, as I understood you to say, he had no chemical analysis of the thing he started with in any case. If I misunderstood you, correct me.

THE WITNESS: Let me make that plain, Judge. If you have a physical mixture of several

materials, all ground up together, an over-all chemical analysis of that ground-up mixture doesn't tell what the individual components would be.

THE COURT: Let me ask you about that—that's one thing I have been missing right along. I don't want to take too long about this, but suppose you have a mixture, a conceded mixture of pure lead and lead oxide.

THE WITNESS: Yes.

THE COURT: Now, I bring you that mixture in a tube, and I ask you what this is—

THE WITNESS: Yes.

THE COURT: — and you don't know anything about it, and you start in and you find there is lead in it and you find there's oxygen in it. Now, in the first place, how much can you tell me about that mixture? Can you tell me that it is lead—by analysis, can you tell me that it is composed of lead and lead oxide, without any question of proportions? Now, suppose that's all there is in it.

THE WITNESS: If the lead oxide happens to be there, red Pb_3O or yellow—

THE COURT: Yes.

THE WITNESS: —or some other oxide, for which a diffraction pattern—

THE COURT: No, no, I am talking about the chemical analysis.

THE WITNESS: For a chemical analysis, it would be necessary to assume which of the oxides

you had present before you could tell the proportions.

THE COURT: In other words, you couldn't take a mixture of PbO and Pb_2O and identify it as that?

THE WITNESS: Except in case there were definite qualitative tests for PbO, in which you could tell you had PbO present to the exclusion of other oxides.

THE COURT: Still,—I am giving you a free rein—all I want to know is can you tell me that that mixture is composed of PbO and Pb_2O? Are you able to positively tell me that?

THE WITNESS: If I can find a definite, qualitative test for PbO—

THE COURT: Well, can you?

THE WITNESS: I don't know.

MR. MORRIS: I think the question your Honor has presented is the chemical end which we are going to deal with with Dr. Ullman.

THE COURT: All right. I've got the wrong man for that.

By MR. MORRIS:

Q. Dr. Davey, your testimony—

MR. MORRIS: Dr. Davey's testimony is merely directed to trying to say or trying to show that some chemical compound has never been identified, the same as his fingerprint expert; but he doesn't tell us how the chemist is going to tell us how to analyze to determine what is in it. Dr. Ullman will tell us that.

THE COURT: All right.

(Discussion off the record.)

By THE COURT:

Q. Wel, we were just going back for a minute on Dr. Clark's proposition and, as I understood you to say, none of his substances that he started with or started to analyze were chemically identified?

A. Correct.

THE COURT: All right. Now, go ahead. That's where we get every time.

MR. MORRIS: I thought he straightened that out a moment ago.

THE COURT: I don't think he did.

MR. MORRIS: May I see what he does mean?

THE COURT: Yes.

By MR. MORRIS:

Q. Dr. Davey, do you mean to say that there is nothing, as you understand it, that Dr. Clark gave no testimony at any time about the chemical analysis, about Berzelius' products or anything else?

A. It is my understanding that Dr. Clark testified that he couldn't tell, in his most highly purified product which he claimed was PbO, that he couldn't tell from that product whether it was PbO or Pb_2O, that his chemical analysis couldn't distinguish it because such a—

THE COURT: Now, just a minute.

By THE COURT:

Q. Dr. Clark said, by his X-ray analysis or, rather, he subjected it to five or six things, and they

have been brought in. I don't know how many, but there were at least six exhibits—diffraction patterns—and one was powder from Exide, from the Exide plant, and one was the oxalate product—it was the same as Berzelius' or Ferrari's—another was Ag_2O and another Cu_2O.

A. Yes.

Q. I think there were two samples of the Exide product. Now, do I understand that your testimony is or, rather, that your recollection of his testimony is that in none of those did he have any chemical analysis of what he started with? Really, if he had no idea of what he was analyzing when he started in, I don't see why he went ahead with it.

A. Well, I wondered myself.

Q. Yes.

A. Let me explain, Judge, in this way: He brought along a record of a diffraction pattern—

THE COURT: Get me that Exhibit 21, if it is available. I don't want to mix things up here, but that's what happens when a judge tries to follow a thing.

(Discussion off the record.)

By THE COURT:

Q. Now, here's a whole lot of those things—

A. Yes.

Q. — termed lead oxide, dust lead, Japanese oxide, and the fractionated product of the Exide mill, and the original Exide, and oxalate, and one thing and another. Tell me,—

A. Now.—

Q. — keep your mind on that; it is Exhibit 21—tell me what you think he knew about the things he started to analyze.

A. Now, he took the diffraction pattern of metallic lead—

Q. Did he know what that was?

A. He knew that it was metallic lead, because the diffraction entity of chemically identified metallic lead is a matter of scientific record. For metallic lead, then, he is in the position of the finger-print expert who has the record of this man's finger-prints. Any time he finds that—the diffraction pattern—he can tie it up with metallic lead.

Q. Yes.

A. Now, going down through the Exide oxide, and the Berzelius oxide, and all the rest of them, when he finds this particular diffraction pattern, he is perfectly justified in saying that metallic lead is present.

Q. Surely. I understand that.

A. In the same way, he had a diffraction pattern of, I think, of red and yellow PbO, did he not?

Q. I don't remember.

A. That's my memory.

MR. WHITCOMB: Yes.

By THE COURT:

Q. All right. He says yes.

A. Both of those are matters of scientific record.

Q. Yes, he must have had that.

A. Any time that he finds a diffraction pattern corresponding to red PbO, he is perfectly justified in saying the oxide contains PbO.

Q. All right.

A. He has, also, a diffraction pattern somewhere—I don't remember whether it's on that sheet or not—of something or the other chemically unidentified, which he got from his oxalate experiment. He

has a diffraction pattern of an unknown material. If you can find that diffraction pattern in the Exide oxide, all he has shown is that, that some unknown material is in Exide oxide, but he still hasn't been able to identify it because it is not a chemically identified material in his standard of comparison.

Q. Yes.

A. He's in the same position as a fingerprint expert who went out on the street and got a set of fingerprints at random and found that they matched the fingerprints he was looking for but he didn't know who he was taking the fingerprint record from. Do you see what I mean?

Q. I see exactly what you mean. I see exactly what you mean, yes.

A. So if he had, as I said—if he had no chemical analysis of the material, giving the—I don't mean the over-all material but of this unknown thing which he calls PbO.

By Mr. Morris:

Q. PbO?

A. No, Pb_2O. Yes, if he had no chemical confirmation of the identity of this so-called Pb_2O, his diffraction pattern is not to be regarded as the diffraction pattern of Pb_2O but is still to be regarded as the diffraction pattern of an unknown material.

Q. Yes.

A. So,—

By The Court:

Q. Go ahead.

A. —he can show the presence of that unknown material in as many products as he wishes, but it is still an unknown material. Now, he has tried to

overcome that defect in his reasoning by saying, as he has testified in his original testimony, that it is plausible to assume the existence of a Pb_2O and that it is plausible to assume a cuprite structure for it.

Q. Well, I still think it would be rather important for him to know what he started with because, if he started with nothing but lead or lead oxide, then your range of unknown substances is limited, isn't it? If you start with a substance absolutely identified as lead oxide and nothing else chemically, your unknown substance must be an oxide of lead. It couldn't be an oxide of copper, could it?

A. No.

Q. Or an oxide of silver?

A. No.

Q. It would have to be an oxide of lead, wouldn't it?

A. Yes. But it may have been some oxide other than Pb_2O.

Q. That's right. I agree. Now, then, that gets you back to your proposition that we are talking about, that we were talking about first; that you say he did not know at first that what he started with was lead oxide and nothing else. That's why I am going after that because, it seems to me, that's rather important. If you know the thing you start with is nothing but those two things, you can't get any other elements in it, can you?

A. Yes. You have at least two oxides of lead before you; at least, two.

Q. Yes, I would agree with that.

A. If you have an unknown oxide of lead—

Q. All right.

A. — mixed with lead in unknown proportions, how can you tell how much lead is tied up with the,

up with the oxygen, and how much with the lead itself?

Q. I haven't gotten that far yet. Can you be sure that the unknown substance is some oxide of lead? You call it an unknown substance and, when you say that, it might be—if you know what you started with, doesn't it have to be some oxide of lead?

A. Well, his material had been mixed up with a lot of oil—

Q. I am still trying to get back to your statement that he didn't know what the material was when he started.

MR. MORRIS: May I ask one or two questions?

THE COURT: Just a minute.

By THE COURT:

Q. That leaves you a field of ten million substances, whereas if he knew—

A. If it was lead and another lead compound, it still leaves the field wide open.

By MR. MORRIS:

Q. Could anybody tell what this unknown ingredient was in the mixture that was handed to him until they had first found out what it was

A. I don't think they could.

Q. He couldn't know what he had was a mixture of lead and lead oxides alone, could he, in toto?

A. No. We are doing him the favor of assuming, for the benefit of the dicussion, that this thing he had was a lead oxide.

THE COURT: I am afraid we are getting our

record pretty elaborate, and I wonder if we could talk off the record a few minutes?

MR. WHITCOMB: Why don't you ask Dr. Clark?

THE COURT: Just leave this off the record.

(Discussion off the record.

THE COURT: Let me ask Dr. Davey a question?

MR. MORRIS: Yes.

THE COURT: Never mind. All right, I will pick it up as we go along. Suppose you go ahead. I have an idea of what you are talking about.

THE WITNESS: What I am trying to—

MR. MORRIS: This becomes part of the record?

THE COURT: Yes.

THE WITNESS: — illustrate, Judge, is that just like a fingerprint man has to have an identified human being to go with the fingerprint, and before some other fingerprint exactly like it means it belongs to this particular man, in this way we must have a chemically identified material to go with this diffraction pattern before Professor Clark can say this diffraction pattern which he found belongs to that particular chemical—and that he has not done.

He says he cannot make the chemical analysis accurately enough—and he is trying to get around that defect in his reasoning by trying

to show how plausible it is to him that if he had a Pb_2O that it would give or would have a cuprite type structure and would, therefore, give a face-centered cubic diffraction pattern.

Now, doing that, he is falling into a syllogical error, the same error illustrated by the old syllogism in college in logic class: This horse is a quadruped, and all quadrupeds, therefore, are horses.

Even though a hypothetical Pb_2O with a cuprite type of structure would show a face-centered cubic type of diffraction pattern, it does not follow that all diffraction patterns of the face-centered cubic type result because of a cuprite type of structure. In fact, Dr. Clark has testified that at least four types of crystal structures would, under conditions like we have in compounds like the oxides of lead, yield diffraction patterns of the face-centered cubic type. So that, even if there had been found a free-centered cubic type of diffraction pattern from the plaintiffs' super-centrifugal material, we are still without a standard diffraction pattern of the so-called Pb_2O.

It has, therefore, not been shown by X-ray methods that there is or ever has been any Pb_2O, if such material exists at all, in the Exide oxide. He is still trying it make all quadrupeds into horses, or so we must assume. We must assume, I think, that his attempt to justify his assumption of a cuprite structure for Pb_2O with a lattice parameter—it is still a case of reasoning in a circle. He is assuming a thing which he tries to prove and so, in answer to your question Judge Morris, in order to identify a material which is handed to a crystal analyst, he must be

able to produce a diffraction pattern from that material which is exactly like the diffraction pattern from some which has already been taken from some chemically identified material.

By Mr. Morris:

Q. Well, now, will you have that read to you? I mean, that last sentence?

(The sentence was then repeated by the reporter, as follows:

". . . He is assuming a thing which he tries to prove and so, in answer to your question, Judge Morris, in order to identify a material which is handed to a crystal analyst, he must be able to produce a diffraction pattern from that material which is exactly like the diffraction pattern from some which has already been taken from some chemically identified materials.")

(Discussion off the record.)

The Witness: Is my answer plain enough to be unambiguous?

The Court: Yes. Go ahead.

By Mr. Morris:

Q. Who is to do the identifying of the material in the case that you speak of in your last statement?

A. I'm not sure whether you refer to the standard material or the material submitted for identification.

Q. I take to you, a crystallographer, a test tube full of a certain material—

THE COURT: Do you tell him what it is, first?

MR. MORRIS: I don't tell him a word about it.

By MR. MORRIS:

Q. — and I ask you to tell me what it is,—

A. Yes.

Q. — can you tell me, or not?

A. I can in case it is crystalline, and in case it is composed wholly of substances whose diffraction patterns are known.

Q. And, in order that their diffraction patterns may be known, what is essential?

A. In order that their diffraction patterns may be known, the diffraction pattern must be—the diffraction pattern must have been obtained from a chemically known, pure crystalline material.

Q. Otherwise, you would be putting a name to what?

A. Otherwise, we would be asked to put a name to an unknown material.

THE COURT: Now, don't you think he had better go on with his notes?

By MR. MORRIS:

Q. Will you proceed with your answer to the remainder of my question, please?

A. Well, we have shown—

THE COURT: Don't you want to read it? I thought it was a pretty good way to do it.

THE WITNESS: Oh, no. I was almost done.

(Discussion off the record.)

THE WITNESS: It has, therefore, not been

shown by X-ray methods that there is or ever has been any Pb_2O, if such a material exists at all, in the Exide oxide because there is no authenticated Pb_2O to use as a starting point as a standard diffraction pattern.

By Mr. Morris:

Q. Does that complete your answer?

A. Yes, sir.

Q. Have you examined the X-ray data offered in evidence by the Plaintiffs and, if so, with what result?

A. I have examined the X-ray data offered in evidence by the Plaintiffs. In so doing, I had the following in mind:

Although I had satisfied myself that no standard diffraction pattern was known for the so-called Pb_2O, Dr. Clark had testified that he believed he had reason to assume that a real Pb_2O would be cubic and would have a cuprite type of structure.

By The Court:

Now, just let me interrupt you there to recall to me what the cuprite structure is. It is different from cubic?

A. The cuprite structure is a face-centered cube, having one kind of atoms in this specious Pb_2O—in this specious Pb_2O, it would be a face-centered cube—then along one of the body diagonals there will be two atoms of oxygen, one of them a quarter of the way along the body diagonal and the other three-quarters of the way along. That structure represents one-eighth of the total unit of the cuprite structure, the other seven-eighths differing from this only in the choice of the body diagonal used.

Q. All right. Then, it is cubic because it is composed of eight cubes. It is composed of eight cubes, you say?

A. No. I have described one-eighth of the structure, but—

Q. Well, as a—

A. —the other seven-eighths is very similar to it.

Q. Well, the whole thing is composed of eight cubes, all together?

A. Yes, and those eight cubes make the smallest quantity in a crystal cuprite that you can have.

THE COURT: All right.

By MR. MORRIS:

Q. Have you finished your difference between a face-centered cubic type and a cuprite structure?

A. Yes, I have answered the Judge's question.

THE COURT: Yes, I understand.

By MR. MORRIS:

Q. I didn't get from your answer, with the clarity with which you have told me before, the difference between the face-centered cubic type of structure and the cuprite structure; and, consequently, I want to ask you if you can have a cuprite structure without first having a free-centered cubic type of structure?

A. If a cuprite structure is a—is composed of two crystal lattices, one of these two crystal lattices is a face-centered cubic lattice and is the one of the cuprite; and, in the case of the specious Pb_2O, the lead is found on the other lattice and is center-leaved with this face-centered cubic lattice of lead in the way that I have described.

Q. Then, won't you have my question read to you and tell me whether the answer is yes or no, Dr. Davey?

(The question was then repeated by the reporter, as follows:

"Q. I didn't get from your answer, with the clarity with which you have told me before, the difference between the face-centered cubic type of structure and the cuprite structures; and, consequently, I want to ask you if you can have a cuprite structure without first having a face-centered cubic type of structure?")

THE WITNESS: In having a face-centered—in having a cuprite structure, you must have a face-centered cubic type of diffraction pattern—one of the two types or kinds of atoms composing the cuprite structure.

By MR. MORRIS:

Q. Then, if I understand you right, Dr. Davey, tell me if I am wrong, won't you, you cannot have a cuprite structure unless you have a face-centered cubic type of diffraction pattern, or have I gone wrong on the diffraction pattern?

A. If you have a cuprite structure composed of two kinds of atoms, one of higher atomic number than the other, and if the one having the higher atomic number is on the face-centered cubic lattice, then the cuprite structure necessarily gives a face-centered cubic diffraction pattern.

Q. All right. Now, then, will you proceed with your answer, Dr. Davey? It is my mistake, as usual.

A. Well, I had—

THE COURT: I think he said he was through.

MR. MORRIS: No. No, that's the second question.

THE WITNESS: —I had just finished saying that Dr. Clark testified that he believed, he had reason to assume, that a real Pb_2O would be cubic and that it would have a cuprite type of structure; thus giving a face-centered cubic type of diffraction pattern.

I have known Dr. Clark for many years. He is a scientist of reputation, and I felt that I should cover the possibility that I had overlooked some bit of evidence which was, perhaps, perfectly obvious to him. So I pretended that there was a real compound, Pb_2O, and I pretended it had a cuprite structure with a lattice parameter of either 3.38 Angstroms, according to Ferrari.

By MR. MORRIS:

Q. But, Dr. Davey—

A. May I just finish that?

Q. —but that a sub zero line of Ferrari was what?

A. 3.38.

Q. Won't you check your memory on that?

A. You are quite correct; Judge, as usual. It is 5.38.

Q. All right.

A. Going back, then, in my notes—is it permissive, Judge, to make these corrections as we go along without messing up the record?

THE COURT: Sure, it is.

THE WITNESS: At that part, where I said "So I pretended that this was a real compound, Pb_2O,

and that I pretended it had a cuprite structure . . . "—

(Part of the answer referred to was then read by the Reporter, as follows:

"A. . . . and I felt that I should cover the possibility that I had overlooked some bit of evidence which was, perhaps, perfectly obvious to him. So I pretended that there was a real compound, Pb_2O, and I pretended that it had a cuprite structure with a lattice parameter of either—")

THE WITNESS: Right there. —5.38 Angstroms according to Ferrari, or 5.32 Angstroms according to Clark.

By MR. MORRIS:

Q. Yes. Go on.

A. I then hunted for evidence of this pretended structure in all the X-ray data submitted by the Plaintiffs. This search was conducted by the well-known slide-rule method described in the literature and in my textbook, "A study of Crystal Structures and Its Applications", on pages 126, 127, 128, and mentioned by Dr. Clark in both editions of his book.

Unless the Court wishes otherwise, I shall assume that the theory and technique of the slide-rule method of interpretation are sufficiently described by the above reference to my book and shall merely say that by this method a face-centered cubic type of diffraction pattern is demonstrated when an exact match is found between lines of the actual experimental diffraction pattern, plotted on a slide-rule, and lines marked in certain definite positions on the inverted slides of the slide-rule.

I have examined in this way each of the four sets of experimental data submitted in evidence by the Plaintiffs. If I may have those four slide-rules (indicating), I can demonstrate what I have done.

Q. All right, here they are (tendering).

A. I have marked on this slide-rule, in pencil, on the lower scale the diffraction pattern of one of the—

Q. Just a moment. Will you begin again? You have marked on this slide-rule what?

A. On the lower scale, in pencil, the diffraction pattern from one of the sets of data submitted by the Plaintiffs. On the inverted slider, I have marked the lines representing a theoretical face-centered cubic diffraction pattern. I should like to show that we have, within a quarter of one per cent, an exact match for certain lines which I have marked on this slide-rule with a cross mark (indicating).

THE COURT: Yes.

THE WITNESS: The lattice parameter of 4.92 corresponds.

By MR. MORRIS:

Q. That's 9.2 Angstroms units.

A. That is 9.2 Angstroms units, yes, and it corresponds to the lattice parameter of metallic lead. I should like to call your attention to the exactitude of the match.

THE COURT: Yes.

THE WITNESS: As nearly as I can determine, the match is accurate to within one-quarter of one per cent.

THE COURT: Of certain lines?

THE WITNESS: Sir?

THE COURT: Not all lines but of certain lines?

By MR. MORRIS:

Q. What lead lines?

A. In the neighborhood of about one and half Angstroms, which we take as a sort of standard position. The line which is furtherest out is out by about a quarter of a per cent.

Q. Those lines represent what?

A. Interplanar spacings.

By THE COURT:

Q. Of what?

A. Of the metallic lead reported by the Plaintiff.

Q. Which specimen was it?

A. It was the one which we were led to believe belonged to Exide oxide. It's the one which is not—C-83—drawn with two complete diffraction patterns.

(Discussion off the record.)

THE WITNESS: It was the first paper submitted by Dr. Clark. Have you the photostats?

(Discussion off the record.)

By MR. MORRIS:

Q. Yes, Defendant's 2. It was the first paper submitted by Dr. Clark. Have you the photostats, now, of the slide-rule in that position?

A. I have here a photograph, a copy of a photograph, of the slide-rule in that position.

Q. Did you speak of the lines on the bottom of the rule, having a line across them?

A. The lines on the bottom of the rule which have the cross mark on them are the lines which show the exact match of the theoretical face-centered cubic pattern for lead.

Q. And this photograph shows the rule in the position in which you just demonstrated it?

A. It does.

MR. MORRIS: That is offered in evidence as Defendant's Exhibit 126.

(Copy of said photograph was then marked as Defendant's Exhibit No. 126.)

By MR. MORRIS:

Q. Now, you have a notation on that photograph—not on your slide-rule but on your photograph—and will you read us what it is?

A. Can I get the photograph?

THE COURT: Oh, is it necessary to read it?

MR. MORRIS: Perhaps not. The other side has not seen it, and I would like to have them see it.

By MR. MORRIS:

Q. All right, you may proceed.

A. On this same slide-rule I have now set the inverted slider to correspond with the theoretical diffraction pattern of a face-centered cube of lattice parameter of 5.30, that is, to the lattice parameter of the face-centered cube preferred by Ferrari.

I should like to demonstrate the lack of a systematic match of the experimental data submitted by the Plaintiffs with the theoretical diffraction pattern for Ferrari's so-called Pb_2O (exhibiting).

Q. The photograph of the rule in that position—

A. This is the photograph of the ruler in that position.

THE COURT: That's what, exhibit what?

MR. MORRIS: 127. I offer this to be marked as the Defendant's Exhibit 127.

(Said photograph was then marked as Defendant's Exhibit No. 127.)

THE COURT: That's the Defendant's Exhibit 127. You offered that in evidence?

MR. MORRIS: I offered that in evidence, and at the conclusion, or sometime, I want to have them all—all that I have offered—accepted in evidence or, perhaps, ruled upon because—unless your Honor's practice is to admit them and no objection is made.

THE COURT: That's my practice, yes, if offered in evidence. Yes.

(Discussion off the record.)

THE WITNESS: You will notice, Judge, that there are a few accidental coincidences here and there, but there is no regular coincidence such that every line in the theoretical pattern is represented by a line in the experimental pattern.

DR. CLARK: I have done it myself, yes.

THE COURT: Well, now—don't put this down.

(Discussion off the record.)

THE COURT: Here are the two. That's what he wants, the two photographs.

THE WITNESS: I have not set the slider on the slide-rule to correspond to a lattice parameter of 5.33, which was Dr. Clark's preferred lattice parameter for the so-called Pb_2O, and I should like to demonstrate to the Court by this slide-rule

that, again, there is no systematic match between the face-centered cubic diffraction pattern to be expected from such an interpretation and the actual experimental data submitted to the Court and the photograph of that I now hand you.

MR. MORRIS: The photograph of that, I now offer in evidence as the Defendant's Exhibit 128.

(Said photograph was then marked as Defendant's Exhibit No. 128.)

(Discussion off the record.)

By MR. MORRIS:

Q. Dr. Davey, will you tell me, please, what the failure of those lines to match, when you assume a parameter of 5.38 Angstroms units, and 5.33 Angstroms units as indicated by Ferrari and by Dr. Clark, respectively, proves?

A. That means that, insofar as can be determined by crystal analysis methods, the Exide oxide contained neither Ferrari's version of the so-called Pb_2O nor Clark's version of the so-called Pb_2O.

Q. Well, does it mean anything further in the way of cuprite structure or face-centered type of diffraction pattern, or anything of that character or order?

A. I have tried systematically to find some position of the slider whereby I could get a match with a face-centered cube.

By THE COURT:

Q. You get the best match for lead, don't you—ordinary lead?

A. The only match we get is for lead.

Q. Yes.

A. I have tried systematically to get matches. I

have taken the first line of the theoretical pattern and have tried it on the first line of the diffraction pattern, excluding the lead lines; I have tried it on the second one, and I have tried it on the third one.

I have tried to get matches on the second line, on the ground that, possibly, Dr. Clark might have missed a line up in here somewhere (indicating.) I have done that on all reasonable ranges of lattice parameter.

Q. Don't you get any PbO—any correspondence?

A. PbO? I suppose you mean red PbO, don't you?

Q. Yes. This thing in here (indicating)—tetragonal litharge?

A. The diffraction pattern for tetragonal litharge is not a face-centered cubic pattern, and would require lines on different positions on the slider from where I have put them.

By Mr. Morris:

Q. What inference, Dr. Davey, do you draw from the fact that you have the lines that match for the lead to within one-quarter of one per cent, as you estimated, and you don't have other lines for the other products that match within whatever percentage you may have determined? I think that's a complete question.

A. The inference is that experimental conditions were such that Dr. Clark was able to make a very precise measurement of the positions of the lines in this diffraction pattern. Otherwise, his lead lines would not have matched the theoretical lines so beautifully. Apparently, he had an excellent diffraction pattern to work with.

Q. Within a like degree of certainty, to wit, one-fourth of one per cent, or accuracy with respect to the lines?

A. Other than his lead lines?

Q. Yes.

A. I assume that he had such accuracy, except in the case of such lines that were too weak to place with certainty in any position.

Q. Your failure to match those lines with a parameter of 5.38 of Ferrari and with a parameter of 5.33 of Dr. Clark, tell us why that is.

A. My interpretation of that is that there is no material in the Exide oxide corresponding to this material which the Plaintiff claims is Pb_2O.

I have here a photographic record of numerous attempts to make matches between the two patterns, other than in the case of lead.

(Discussion off the record.)

Mr. Morris: Now, I offer those photostats, twelve sheets, in evidence as the Defendant's Exhibit 129.

(Twelve photostats marked as the Defendant's Exhibit No. 129.)

(Discussion off the record.)

The Court: Well, you want to finish that.

The Witness: Yes. The record shows that I have been unable to make any match with the face-centered cubic pattern except in the case of metallic lead.

By Mr. Morris:

Q. Will you proceed from there, Dr. Davey, please?

A. I have made similar tests of the Plaintiffs' data, submitted as C-83.

Q. I hand you that exhibit (tendering). Do you want to refer to it as that Plaintiffs' number?

A. Plaintiffs' No. 59, yes. Do you want these marked?

Q. It's the Plaintiffs' Exhibit 59. Will you proceed to tell us what results you have found?

A. I have marked on the slide-rule the data of Plaintiffs' 59, and on the inverted slider I have marked the theoretical face-centered cubic diffraction pattern. I find a face-centered cubic diffraction pattern of lattice parameter of 4.92, corresponding to that of metallic lead. The match between the experimental data and the theoretical data is, again, most excellent. I estimate it to be a match within a quarter of a per cent, as before.

I have now set the slider—do you want to give that? This is the one I have just finished.

Q. The rule is set—the rule as set and as last testified to by the witness was photographed?

A. Yes.

MR. MORRIS: And the photograph of the rule in that setting, I offer in evidence as Defendant's Exhibit 130.

(Said photograph was then marked as the Defendant's Exhibit No. 130.)

(Discussion off the record.)

THE WITNESS: I have now set the slider on the slide-rule to correspond to the theoretical diffraction pattern of a face-centered cube of lattice parameter of 5.38, corresponding to the cuprite structure of Ferrari. As in the case of the previous set of data, there is no systematic match between the date submitted and the theoretical face-centered cubic diffraction pattern of lattice parameter of 5.38.

THE COURT: All right.

(Discussion off the record.)

By Mr. Morris:

Q. Do you have a photograph of that?
A. I do.

(Discussion off the record.)

Mr. Morris: I offer the photograph of that setting in evidence as the Defendant's Exhibit 131.

(Said photograph was then marked as Defendant's Exhibit 131.)

Mr. Whitcomb: Your Honor, I suppose you want anything we have to say about it to be held for rebuttal?

The Court: Yes.

Mr. Whitcomb: Dr. Clark thinks he has omitted three-fourths of the lines.

The Court: All right. Go ahead.

The Witness: I should be glad to have Dr. Clark check the slide-rules with the data which he has submitted. Here's the first one I have used if he wants to try it.

Mr. Whitcomb: It's not the slide-rule; it's the data.

The Witness: The data? I can't help that.

(Discussion off the record.)

The Witness: The first figure given under the column D on the Plaintiffs' 59 exhibit is 3.423. The first line on the slide-rule is 3.42 and a fraction, which is intended to be three within the width of a pencil mark.

The second line on the data sheet is 3.096, and the second line on the slide-rule is 3.096 within the precision of the width of a pencil mark.

The third figure on the data sheet is 2.840: the corresponding line on the slide-rule is 2.840.

The next one on the data sheet is 2.788. I find the 2.788 is on the slide-rule.

The next one is 2.738, and I find 2.738 on the slide rule.

The next figure is 2.609, and I find 2.609 on the slide-rule.

The next figure is 2.510. I find a 2.510 on the slide-rule.

The next figure is 2.461, and I find the 2.461 on the slide-rule.

The next figure is 2.199—

DR. CLARKE: Pardon me, just a minute. Are you trying to fit every single one of those numbers into the face-centered cubic lattice?

THE WITNESS: No. I am trying to find anything which I can pick out from that—that I can fit into a cube, or a face-centered cube lattice—and the only lines I have been able to pick out, by the way, are those of lead.

DR. CLARK: They are beta.

THE WITNESS: If they are beta lines, they are not—if you should have beta lines, you should have had some alpha lines.

(Discussion off the record.)

THE WITNESS: We made no alibies for the data. We plotted everything that was submitted as evidence and, if there are any beta lines here, we have increased your chance of finding a match

with some theoretical pattern because, in that case, we have put in some additional lines rather than taking them out.

(Discussion off the record.)

By Mr. Morris:

Q. I don't seem to remember what this tabulation for Plaintiffs' Exhibit 59 is for. Do you recall, offhand?

A. I have never been able to find out from the testimony what C-83 meant. Either my memory is poor or it was not brought out clearly, so that all I can tell you is it is a diffraction pattern of something.

Mr. Whitcomb: Oxalate.

The Witness: Oh, yes; C-83 is oxalate.

By Mr. Morris:

Q. That is C-83, which is Plaintiffs' Exhibit 59. Will you proceed, Dr. Davey, please?

A. Continuing our experiments with the slide-rule, I have set the slider to show the theoretical diffraction pattern—excuse me—I have set the slider of this slide-rule to show the theoretical face-centered cubic diffraction pattern corresponding to a lattice parameter of 5.33, which is Dr. Clark's preferred parameter for Pb_2O.

The Court: I think they want to relay stenographers at this point, and we will now have a little recess.

The Witness: I should like to submit the slide-rule with the slider in this position to demonstrate that there is no systematic coincidence between the experimental data or any portion

thereof and Dr. Clark's version of the theoretical structure for Pb_2O, so-called.

By Mr. Morris:

Q. Have you a photograph of the rule in that position?

A. I have.

Mr. Morris: I offer the photograph in evidence as Defendant's Exhibit 132.

(Photograph of slide-rule calculation of the witness Davey was marked Defendant's Exhibit 132.)

By Mr. Morris:

Q. Will you proceed?

A. As before, I have made systematic attempts to find matches of a face centered cubic diffraction pattern on the data from this data sheet as submitted by the plaintiff.

The Court: Which is this C83?

Mr. Morris: Plaintiffs' Exhibit 59, referred to sometimes as C83.

The Witness: C83, yes.

By Mr. Morris:

Q. All right, with what result, Dr. Davey?

A. Using any reasonable limits on each side of the lattice parameters used by Clark and Ferrari, I can find no systematic match. These photographs are photographs of the slide-rule in the positions for such tests.

Mr. Morris: I offer those photographs in evi-

dence; being fifteen sheets, as Defendant's Exhibit 133.

(Photographs of slide-rule demonstrations by the witness, Davey, were marked Defendant's Exhibit 133.)

By Mr. Morris:

Q. What is your conclusion from the facts which have been testified to by you with respect to your inability to obtain a match from the data submitted by plaintiff in this case?

A. From thet wo diffraction patterns taken up so far in this testimony the conclusion is that no—the conclusion is that there has been no demonstration on the part of the plaintiff of the presence of the diffraction pattern which they attribute to Pb_2O in either of the two materials which they have investigated.

By the Court:

Q. That is, even the pattern isn't there?

A. Even the pattern isn't there.

Q. The thing that they said anybody could see does not—

A. Correct.

Q. —exist?

A. That I believe I have demonstrated sufficient to the Court. I have here—

Mr. Morris: Just a moment.—

By the Court:

Q. Now, I just want to get that clear in my mind. Now, this testimony is going to the effect that these lines are not where Dr. Clark said they were, is that what it amounts to?

A. That is about what it comes to.

Q. That actual measurement shows that those lines are not where he said they were?

A. Yes.

Q. In this strip of film?

A. Correct.

By Mr. Morris:

Q. Now, Dr. Davey, maybe I didn't understand this—

The Court: Well, but, now, everybody shakes their head when I say that, except the witness, and he says that is correct.

Mr. Morris: Well, I don't know just what he means by that, it may be correct, I don't know.

The Witness: I don't mean, Judge, that the lines are not where the data sheets say they are. I mean that the lines are not where his interpretation of the data sheet would call for them to be.

The Court: Well, unfortunately,—

The Witness: That doesn't answer the question—

The Court: —I don't understand it, I don't understand that answer.

By the Court:

Q. This is what he sees, isn't it?

A. Yes.

Q. That is the think he actually sees (indicating. Now, does your testimony go to the effect that his measurements are wrong that he took on the data sheet?

A. No, my testimony says nothing about—

Q. All right, I want to understand: that is not your testimony?

A. I haven't testified that his measurements are incorrect.

Q. When he measured the location of these lines he measured them correctly?

A. I think I know Dr. Clark well enough to—

Q. In other words, you—

A. —take it for granted—

Q. All right.

A. —that the measurements he has made and recorded there are measurements from that film.

Q. All right.

A. But he has given an interpretation of his measurements, namely,—

Q. By saying that they correspond?

A. —by saying that he has a diffraction pattern corresponding to a cuprite cube.

Q. All right.

A. That is, that he has found a face centered cubic diffraction pattern which he interprets as representing a cuprite cube of Pb_2O. I have shown that taking either Ferrari's date or a cuprite cube or Clark's own data for the cuprite cube that the data which he has presented does not match the theoretical data for either of those two, for the diffraction pattern from either of those two supposed cuprite cubes.

Q. Well, then, what was wrong, was he wrong in placing the lines on his standard, or was he wrong—you say he was not wrong in placing it on the patterns that he got?

A. No. I give full faith to the—to the experimental evidence.

Q. Well, did Dr. Clark say—

A. I think he has fallen into error in his interpretation of his data.

Q. I wish you could make it—

A. I have here another slide-rule which I think will bring that out a little more fully.

Q. I was going to say I wish you would make that a little clearer to me.

By Mr. Morris:

Q. And now, please, Dr. Davey, may I try just for a moment to see whether I can get it, because I haven't it any clearer than your Honor has, if anywhere nearly so clear.

The Court: Well, I believe you have, Judge.

Mr. Morris: No, sir, but I am going to try to get it, wherever it falls.

By Mr. Morris:

Q. If I understand you aright, Dr. Davey, you accept Dr. Clark's measurements as he had handed them to us?

A. I certainly do.

Q. You start from there?

A. Yes, sir.

Q. On the assumption that they are correct,—

A. Correct.

Q. —that he measured accurately?

A. Yes, sir.

Q. Now, then, if I understand you aright, and I don't know that I do, but if I do, you take those measurements and find whether you can find in those measurements evidence of a cuprite structure?

A. Correct.

Q. And you do or do not find it,—

A. I do not find it.—

Q. —from those papers?

A. —any evidence of a cuprite structure in the measurements which he has submitted.

The Court: Surely, I understand that, that far. I understand all along, that is just the begin-

ning, but you speak of correspondence with a theoretical structure.

THE WITNESS: Yes.

By THE COURT:

Q. Now, where did you get that theoretical structure with which you cannot find any correspondence, and Dr. Clark can find correspondence?

A. Well, Dr. Clark has testified that his so-called Pb_2O must have the cuprite structure, and he has submitted to the Court a photograph of a model of that structure.

Q. Yes.

A. Now, granting the configuration of atoms in that model, and taking for the edge of the unit of structure in that model the value of 5.338, it is possible to calculate what the interplanar spacings in that model should be.

Q. All right, now, that is what you did?

A. That is what I did.—

Q. And you found no correspondence?

A. —and there is no correspondence.

Q. Well, now, what did he do?

A. Well, I hope with the next two slide-rules to show what we think he did.

Q. Well, the slide-rules don't help me.

A. Because he has submitted two other lots of data.

Q. Well, all right.—

A. Or, rather, two data sheets.

Q. I would like to know what he did, in other words, where the difference comes in. It is a general statement, I understand that you are saying he misinterpreted his data, and that you do not place the same interpretation, but you found a certain lack of correspondence—

A. Yes.

Q. —between those and a theoretical cuprite structure. Now, did he find an exact correspondence, or a fairly exact correspondence, or didn't he try?

A. I think he did try.

Q. You say—

A. This is opinion, now, not fact.

Q. No, but is there anything in his testimony to indicate that he did or did not, or tried to do it?

A. His testimony indicated, and the examination of his data indicated that he picked certain lines as corresponding to the diffraction pattern of his so-called Pb_2O.

Q. Well, now, did his—

A. And that he has—

Q. Well, now, what is wrong with it, did he pick the wrong lines, or don't they correspond when he says they do?

A. I am inclined to think that he picked the right lines but they do not correspond within the precision of his measurement to what is required for the structure which he thought he had. He must allow himself an experimental error for those lines many times in excess of the experimental error which he evidently has for his lead. Before he can account—

Q. Well, then, the difference—

A. —for the differences—

Q. All right.

A. —between the diffraction pattern and the theoretical.

Q. The difference, as I understand is, is that he missed—this is all your interpretation, but that he missed this correspondence by so wide a margin that you say it cannot be the same thing. He agrees with you that he missed it by that margin, but says that is a fair percentage of lack of precision?

A. I think that is a very fair statement.

THE COURT: Well, all right.

By MR. MORRIS:

Q. Now, I bring your attention to Dr. Clark's testimony of this morning, if that is of any service to you in this connection, I don't know whether it is or not,—

THE COURT: I am just trying to get at where you say he is wrong, and I think I understand now.

THE WITNESS: Dr. Clark this morning—

THE COURT: I hope I don't get thrown off again—what?

THE WITNESS: Dr. Clark this morning attempted to account for this discrepancy which he undoubtedly knew was there in terms of a distortion of his crystal lattice.

THE COURT: Yes.

THE WITNESS: He avoided the use of the word "solid solution", but his testimony very plainly stated to anyone who has studied solid solutions that he assumed a—that he assumed the possibility of a continuous solid solution of oxygen in lead, all the way from a negligible amount in pure lead up to an amount approaching that of PbO. The minute that he has asumed that he has, of course, vitiated his original testimony as to the existence of a definite compound, Pb_3O.

THE COURT: Well, I understood that.

THE WITNESS: Because he has no definite—

THE COURT: Well, all right, I didn't want to get mixed up any more.

THE WITNESS: Does that satisfy you?

THE COURT: I have got a grasp of something now.

THE WITNESS: Does that answer your question?

THE COURT: Yes, that is all right.

By MR. MORRIS:

Q. Now, will you pass to your other slide-rule tests, please?

A. Now, the next slide-rule test is in connection with the Plaintiffs' Exhibit 53, which gives a set of X-ray diffraction data on the fractionated Exide sample corresponding to 9, 10 and 11.

Q. Plaintiffs' Exhibit 21?

A. Plaintiffs' Exhibit 21.

By THE COURT:

Q. Well, may I just go back again, if you agree that Dr. Clark found the same discrepancies that you find what is the use of all this slide-rule business?

A. I am trying to make it a matter of record.—

Q. Well, but you say—

A. —how great the discrepancies are.

Q. Well, but you say he has agreed to that.

A. He has mentioned that there are discrepancies in one line this morning.

Q. Yes.

A. I am trying to show there are discrepancies all the way hrough his pattern and I am trying to demonstrate how great those discrepancies are.

Q. All right.

A. I have marked on the body of the slide-rule the data in the last column of Plaintiffs' Exhibit 53.

Q. 53?

A. His Exhibit 53 gives his diffraction data from certain—

Q. Exide samples?

A. —Exide samples, and Ferrari's data, and data from a co-worker of Dr. Clark's by the name of Schieltz, and it is Schieltz's data that I have recorded on the slide-rule.

Now, I want to call your attention to a peculiarity of the lack of match here. I am now making a match between the first theoretical line and the first experimental line. You will notice that the second experimental line is too small, readings to the left are smaller than readings to the right.

The third line is too small.

The fourth one gives a very good match.

The fifth one is too small.

The sixth one is too small.

The seventh one does not match at all.

The eighth one is too small.

The ninth one is too small.

The tenth one does not match at all.

The eleventh one is too large.

And the twelfth one is too large.

Now, the amount of error which would be required in order to justify pushing those experimental lines up to a more exact match is many times the experimental error which we have seen is inherent in his readings of his films.

We can make a similar attempt by making our correspondence between the second theoretical and the second experimental line, and you see that we are no better off. If we try down on the 1615 line we are no better off, and so on.

By Mr. Morris:

Q. Have you a photograph?

A. I have a photograph of the slide-rule in that, in the position for Ferrari's lattice parameter and in the position for Clark's lattice parameter.

Q. The first being Ferrari, and the second for Clark?

A. Correct.

Mr. Morris: The first I offer in evidence as Defendant's Exhibit 134, and the second, being Dr. Clark's, I offer in evidence as 135.

(Photograph of slide-rule for Ferrari's lattice parameter, produced by the witness Davey, was marked Defendant's Exhibit number 134.

Photograph of slide-rule in the position for Clark's lattice parameter, produced by the witness Davey, was marked Defendant's Exhibit number 135.)

The Witness: There was still a fourth data sheet submitted by the plaintiff, which was labeled with the words "Highest accuracy". I assume therefore, that this represents the best possible data, or the combination of the best possible data for the so-called Pb_2O. I have now set the diffraction pattern—I have now set the theoretical diffraction pattern to correspond with Ferrari's lattice parameter, and the highest accuracy data of the plaintiff do not correspond to the theoretical pattern.

The Court: Doesn't hit anything.

By Mr. Morris:

Q. That has a parameter of 5.38?

A. 5.39. I now set the slider—I now set the slider for the lattice parameter of 1.533, and wish to demonstrate again a lack of corespondence of the plaintiffs' highest accuracy data with the theoretical diffraction pattern.

Q. Don't change your rule, please. What is your lattice parameter on there?

A. My lattice parameter is 5.33.

Q. So you were inaccurate a moment ago when you said 1.33?

A. Did I?

THE COURT: Yes.

THE WITNESS: I am very sorry. I intended to say 5.33.

MR. MORRIS: Very well.

By MR. MORRIS:

Q. In your previous setting you said 5.39. I am wondering whether you had it 5.39, or whether you had Ferrari's dimension.

A. 5.39 is Ferrari's dimension.

Q. No, you know we had that discussed a while ago. Won't you turn to Ferrari and refresh your recollection?

A. Excuse me, 5.38, you are quite right.

Q. You had it set—

A. 5.38.

Q. —at 5.38?

A. Yes.

By THE COURT:

Q. This parameter is the same as the "a sub zero" thing?

A. Yes, "a sub zero" is the lattice parameter.

Q. Yes.

A. Now, the testimony on behalf of the plaintiff this morning indicated that these discrepancies were to be interpreted in terms of amounts of oxygen in the crystal differing from the ratio of oxygen to lead required by the chemical formula Pb_2O.

By MR. MORRIS:

Q. Which would distort, but would not change—

A. Which it was claimed would distort a lattice.

Q. But would not change—

A. But would not change its essential nature.

Q. Yes.

A. I have examined the diffraction pattern as it stands by a method similar to the slide-rule for other types of crystals than the cubic type, and I have been able to find at least as good a match in the tetragonal system, at least as good a match with the rhombohedral system, at least as good a match with the hexagonal close packed type of crystal. This leaves the plaintiff, I think, with an embarrassing freedom of choice as to what sort of distortion they may have in this hypothetical material Pb_2O.

If I remember correctly this morning's testimony dealt with the lack of coincidence for a line in the neighborhood of 1.66. Is that correct, or was it 2.66? Dr. Clark says it is 2.66.

I should like to call the attention of the Court to the fact that not only is 2.66 out of position as required by the theoretical diffraction pattern, but that every other line in the diffraction pattern is out of position except the first one, namely, 1—namely, excuse me, 31, practically one—09, I think it was, wasn't it? In order to get a match for the lines in the diffraction pattern of relatively small interplanar spacings it is necessary to move the slide-rule up bit by bit until a match has been obtained first with the line at one, at approximately 1.935, then move it still more to get a coincidence with the next, for the next two lines, then move it backwards to a coincidence with the next two lines.

Of course, if we assume that we can have any amount of oxygen present, so that we get a continuous distortion of the crystal from metallic lead up to some form of PbO, then there is no obedience to the law of definite proportions, and, therefore, no evidence of a

chemical compound at all. Solid solutions are not limited to the illustrations which—

By THE COURT:

Q. What is the law of definite proportions?

A. Sir?

Q. What do you mean by the law of definite proportions?

A. It is the fundamental law of chemistry, it is the definition of a chemical compound, that is a chemical compound the elements are present in definite proportions.

A. Sir?

Q. What do you mean by the law of definite proportions?

A. It is the fundamental law of chemistry, it is the definition of a chemical compound, that is a chemical compound the elements are present in definite proportions.

Returning to my previous sentence, examples of solid solutions are not at all limited to those which were given this morning. Solid solutions have been well known to metallurgists for years, and most of our useful alloys are solid solutions.

Q. What is a solid solution? What significance has that term in this?

A. In a solid solution the atoms of the solute either occupy positions which would have been occupied by atoms of the solvent, or else occupy intermediary positions, pushing the atoms of the solvent somewhat out of their normal places. I might illustrate it this way: a solid solution has the same relation to the solid state that a solution of one liquid in another liquid has to the liquid state. A solid solution represents one solid dissolved in another solid, just as one liquid can be dissolved in another liquid, —

MR. WHITCOMB: If your Honor please,—

A. —or just as a solid can be dissolved in a liquid.

MR. WHITCOMB: —I wanted to make a statement because the witness said something about us purposely avoiding it. That is, in our rebuttal, we are going to talk about in rebuttal.

THE COURT: What is that?

MR. WHITCOMB: The solid solution proposition.

THE WITNESS: Well, if you wish, Mr. Whitcomb, I am defining the state of affairs illustrated in this morning's testimony by the word "solid solution", which is the ordinary—the statements this morning are the ordinary conception of what a solid solution is.

By MR. MORRIS:

Q. Dr. Davey, won't you turn to page 1134 of the testimony before you, which is the transcript of Dr. Clark this morning, and I thought you used a moment ago in your calculation $PbO_{2.000}$, and I have sent for the testimony to see, and I may be wholly in error as to what you were referring to, but that seems to be sub 1.66.

A. I am afraid we are not talking of the same thing,—

Q. All right.

A. —Judge Morris.

Q. Very well.

A. I was talking of the interplanar spacings corresponding to the lines in his sheet representing, labeled highest accuracy.

Q. Very well.

A. And not referring to any subscripts of any suppositious compounds having fractional proportions.

Q. At the moment I thought you were asking Dr. Clark as to whether he referred in that particular instance to a snbscript of 1.66 or 2.66.

A. No.

Q. I was in error.

A. I was referring to the interplanar spacings.

THE COURT: I wonder if we could come to about the point of adjourning now.

MR. MORRIS: Of course, at your Honor's convenience. Dr. Davey must, of course, go into his examinations of these Exide, or defendant's product, and the Toronto product.

THE COURT: Oh, yes, of course he must, and I am wondering whether all this testimony so far, it is certainly awfully irregular to have one witness criticize the testimony of another witness, but I thought it was all right, and it is all right, it is really helpful, except that we are going to get possibly an almost endless chain, because Dr. Clark will now take up Dr. Davey's testimony on the stand, and I wonder where we are going to stop. It wasn't objected to, it wasn't objected to. Of course, it is a very unusual form of expert testimony.

MR. WHITCOMB: Well, we did attempt to make —we made an objection.

THE COURT: No, you didn't make that objection, you asked whether he was stating a harangue about Dr. Clark. I didn't understand you—

MR. WHITCOMB: That was a form of objection—

THE COURT: What?

MR. WHITCOMB: I intended that to be in he form of an objection.

THE COURT: It wasn't very clearly put, if it was.

(Discussion off the record.)

MR. BETTS: I ask that we may reserve the right to move to strike any part of Dr. Davey's testimony.

THE COURT: All right, we will meet that when it comes up. It is a matter of discretion, anyway.

Adjourned until Tuesday, October 8, 1936, at ten o'clock A. M.

DEFENDANT'S EVIDENCE (Continued).

MR. BETTS: May it please your Honor, the parties have a stipulation to read in the record,—

THE COURT: All right.

MR. BETTS: —as follows. It is stipulated that defendant paid the expenses of the Interference proceedings between Hall and Shimadzu, the record of which is marked Plaintiffs' Exhibit 41

MR. MORRIS: It is so stipulated.

WHEELER P. DAVEY, recalled.

Direct-examination (Continued).

By MR. MORRIS:

Q. Dr. Davey, have you made any X-ray diffraction patterns of certain official specimens and other speciments in connection with this litigation?

A. I have.

Q. What specimens did you examine, and what results did you find?

A. I received a series of samples to which I gave serial numbers, which were sent to me under serial numbers in a letter of transmittal, and which had on the containers the description which I shall read in connection with these. My serial number 1, serial number in letter of transmittal, 1, wording of label—

THE COURT: Now, wait a minute, let me have 21, again, Plaintiffs' 21.

(Discussion off the record.)

By THE COURT:

Q. All right, now, go ahead, your serial number 1 and letter of transmittal 1 was what?

A. Official sample gray oxide, run number 21, mill number 1.

By MR. MORRIS:

Q. That would be presumably the same as 6 on there?

A. Same as 6, yes. Time, 1.30 P. M.; finished product May 25, 1934.

THE COURT: Well, without going into that, is it agreed that that would be the same as number 6 on 21, that is, what is labeled Exide oxide here?

MR. MORRIS: May I put it this way? I think they will probably stipulate this wise, that what Dr. Davey is speaking of now is a test or is an examination of one of the samples of defendant's product,—

MR. WHITCOMB: Submitted by Dr. Wilson.

MR. MORRIS: One of Dr. Wilson's samples.

THE WITNESS: Yes.

THE COURT: And corresponds, possibly not identically with, but corresponds to number 6.

MR. MORRIS: May I put it this way; and that number 6 on Plaintiffs' Exhibit 21 was likewise—

THE COURT: That is all right, just so long as I get them tied up—likewise—

MR. MORRIS: —one of Dr. Wilson's samples.

THE COURT: Yes.

THE WITNESS: Completing the reading of the wording, bottle number 1,—

THE COURT: Oh, you don't need to do all that.

THE WITNESS: —signed J. H. W.

THE COURT: Well, just let's get what they are.

THE WITNESS: My serial number 2, letter of transmittal number 2.

By THE COURT:

Q. Now, what was that?

A. Official sample gray oxide, run number 21, mill number 1, time 2.10 P. M.

Q. Well, that was the same thing?

A. Under screen—

Q. Another of Dr. Wilson's samples?

A. Another of Dr. Wilson's samples.

Q. Can you abbreviate it by saying another of Dr. Wilson's samples?

A. Do I understand, Judge, that you wish me just to state that I had so many samples from Dr. Wilson,—

Q. That is all that is necessary.

A. —or shall I describe them completely?

By Mr. Morris:

Q. If you will tell us that you made examination of certain samples, and the number of them, which samples were taken by Dr. Wilson, and then give us the results of that examination I will be obliged.

By The Court:

Q. How many?

A. I have six samples all labeled official samples, all labeled, signed J. H. W.

Q. And they all—

Mr. Morris: —were defendant's gray oxide produce?

The Court: Yes.

The Witness: They were all gray oxide.

The Court: All right.

The Witness: I had in addition a sample, it was my serial number 7, serial number in the letter of transmittal number 7, for which the label was merely sample number 28.

By Mr. Morris:

Q. And no designation?

A. There was no designation on that sample.

Q. So you made a blind examination of that without knowing where it came from?

A. Yes.

MR. MORRIS: All right, we will show that that was a Toronto sample, but Dr. Davey didn't know it.

THE COURT: Well, it was a Toronto sample, all right.

MR. MORRIS: It was a Toronto sample.

THE COURT: All right.

MR. MORRIS: I will show that by another witness.

THE WITNESS: My serial number 8, serial number 13 in the letter of transmittal, mechanical mixture—

By THE COURT:

Q. What does that mean?

A. —67.51 per cent red PbO after Cohen.

A. 51 per cent red PbO, after Cohen; 32.49 per

A. 57 per cent red PbO, after Cohen; 32.49 per cent Eimer and Amend finest powder.

Q. What does that mean?

A. That is a mechanical mixture of red lead oxide and the material which Eimer and Amend claim is lead, but which is actually again a mixture of lead and red lead oxide.

Q. In a general way would that correspond to anything on 21?

A. Not according to my memory.

Q. All right.

A. My serial number 9, letter of transmittal, serial number 8, gray oxide sample number A-2 near middle of mill.

Q. Is that from the defendant's mill?

A. Apparently not an official sample because it has no signature from Dr. Wilson.

Q. But it was from the defendant's mill?

By Mr. Morris:

Q. It was a product from defendant's mill, as I understand it.

A. So I understand. It was labeled number A-2, near middle of mill.

The Court: All right.

The Witness: My serial number 10, serial number in the letter of transmittal number 9, gray oxide sample number B-2 near discharge end of mill.

My serial number 11, serial number in letter of transmittal 12, Eimer and Amend lead metal, finest powder.

My serial number—

By The Court:

Q. Well, that would correspond with what he calls test lead on his number 2?

A. I presume it would correspond to test lead, except that it came from a different source.

Q. Yes, isn't that right, it generally corresponds with your test lead.

Dr. Clark: Yes, of course, these very fine powders usually have oxide in them.

The Court: Well, I mean, I am just trying to get what it corresponds to in your 21. It would be number 2 on your 21, which you have got marked test lead?

Dr. Clark: Yes, that is right.

THE COURT: All right, we have that. That is number 9.

THE WITNESS: That is sample number 11 in my serial series, I used as a material from which to get a comparison standard of metallic lead.

THE COURT: Yes.

THE WITNESS: Of the diffraction pattern of metallic lead.

THE COURT: All right, it was your test lead.

THE WITNESS: I used not only this test lead but also the value given in the International Critical Tables for the lattice parameter of pure lead.

My serial number 12, serial number in the letter of transmittal number 10, yellow PbO after Cohen.

By THE COURT:

Q. What was your number 12?

A. Yellow PbO after Cohen.

Q. Well, now, wait a minute, that corresponds to number 1, doesn't it,—

A. Presumably.

Q. —on 21?

A. Presumably, yes.

Q. All right, that is number 1.

By MR. BETTS:

Q. What is the last word?

THE COURT: Yellow PbO.

THE WITNESS: After Cohen.

THE COURT: Oh.

THE WITNESS: Cohen is the gentlemen who

made the recipe which is regarded as standard for making yellow PbO.

My serial number 13, no serial number in the letter of transmittal, red PbO after Cohen.

By THE COURT:

Q. Well, that corresponds, roughly, to number 3 which he has, tetragonal PbO, isn't that right?

A. So I understand.

Q. All right.

A. In addition I received two lead balls from Mr. C. A. Hall, of the Electric Storage Battery Company. These balls reached me in sealed tin cans in an atmosphere of nitrogen. They had been taken according to Mr. Hall's letter of transmittal from the body of the mill. They were marked "balls".

THE COURT: I hope they were cool by the time you got them. When I sampled them they were hot down to the middle.

THE WITNESS: They were put in this atmosphere of nitrogen as soon as—

(Discussion off the record.)

THE WITNESS: May I go back a little bit, to get continuity?

(Interruption.)

By MR. MORRIS:

Q. Will you proceed?

A. May I ask the stenographer to read as far as I have gone in answer to this question, the last two sentences in answer to this question, so that I may get continuity.

(The answer was repeated by the Reporter, as follows:

"These balls reached me in sealed tin cans in an atmosphere of nitrogen. They had been taken according to Mr. Hall's letter of transmittal from the body of the mill. They were marked 'balls'.")

THE WITNESS: These balls had been taken from the mill as rapidly as possible, had been put in the cans with nitrogen, and had been sealed with as little loss of time as possible. This information I have direct from Mr. C. A. Hall. These two balls became my samples 53-A and 53-B.

MR. SCHAFFER: If Your Honor please, we move that the part of the answer relating to how the balls were collected and shipped be stricken out.

MR. MORRIS: No objection.

THE COURT: Oh, yes. It is all right.

By MR. MORRIS:

Q. Will you proceed, Dr. Davey?

A. I have made the following investigations of these samples. I have investigated the Eimer and Amend lead finest powder, and find that it is composed very largely of red PbO, the remainder being metallic lead.

I have treated the PbO from Eimer and Amend finest powder with acetic acid, and the residue gives nothing but the diffraction pattern of metallic lead.

I have compared on the same film the diffraction patterns of Eimer and Amend's finest powder with the mechanical mixture of Pb and red PbO, and find that the lines are in identical positions.

May I ask whether I said on the same film?

THE REPORTER: Yes, you did.

THE WITNESS: I have compared the mechanical mixture of Pb and red PbO with each of the six official samples and find exact correspondence between the lines. I find no additional lines on the official samples of gray oxide which are not present in the diffraction pattern of the mixture of metallic lead and red PbO.

By THE COURT:

Q. No diffraction lines at all?

A. No extra lines which are not on the mechanical mixture.

By MR. MORRIS:

Q. Now, I don't know whether the last statement is clear. You find lines for lead and red PbO?

A. Correct.

Q. And no other lines than those representing lead and red PbO?

A. Correct.

By THE COURT:

Q. Well, that, of course, is directly in conflict with what Dr. Clark testified that he found in the same samples,—

A. Correct.

Q. —or the corresponding samples?

A. Yes.

THE COURT: All right.

MR. MORRIS: We shall show, if Your Honor please, so that you may have in mind that we are going to show, we are going to show that by this witness, we are going to show that by Dr. Anderson—

THE COURT: Well, that is all right. I didn't

want to inquire into that, but I just wanted to be sure that that was a direct—

THE WITNESS: You are quite correct.

MR. MORRIS: I was only telling you that so you would have the trend of what our testimony is going to be.

THE COURT: All right.

THE WITNESS: There is a difference between my experimental results and the experimental results which have been submitted by the plaintiff.

THE COURT: All right.

THE WITNESS: I have examined the material which was delivered to me as my serial number 7, designated on the container as sample number 28, and I have compared on the same film—excuse me—and I have compared the diffraction pattern so obtained with the diffraction patterns of red PbO and with the data for metallic lead calculated from the standard data given in the International Critical Tables. This diffraction pattern of my serial number 7 was a precision diffraction pattern, so that it was correct to compare my written data with the data from the International, calculated from the International Critical Tables and with the data for red PbO. I find that specimen number 7 coming from the container labeled sample number 28 contains metallic lead, red PbO, and no other crystalline material.

By THE COURT:

Q. That is the Toronto mill product?

A. Excuse me, I didn't hear you.

Q. It is the Toronto mill product?

By Mr. Morris:

Q. That is what you found out after you had made the analysis was the Toronto mill product?

A. After I had made the analysis and submitted my report on it, then and not until then was I told that it was the Toronto mill product.

I have examined the two lead balls submitted to me by Mr. Hall, which were my specimens 53-A and 53-B. The specimens were prepared by putting the tin cans in an atmosphere of nitrogen, opening the tin cans in an atmosphere of nitrogen, as proved by the fact that a match would not burn. Nitrogen was being pumped into this container continuously from a tank of nitrogen. The balls were opened in this oxygen-free space. The coating from the balls was scraped off, was diluted with corn starch, in the customary manner, and was loaded in the specimen tubes. The specimen tubes were sealed with Penn State wax.

The balls were returned to the tin cans. The tin cans were soldered shut again, all in an atmosphere of nitrogen, and the absence of oxygen was shown again at the end of this operation by the fact that a match would not burn. It is evident, therefore, that there was no chance for subsequent oxidation of the coating of these balls during the time that we had open the tin cans and had loaded the specimen tubes.

My X-ray examination of the coating from these two balls shows in each case the presence of metallic lead and the presence of red PbO.

In the case of specimen 53-A there were no other lines in the diffraction pattern except those corresponding to metallic lead and red PbO.

In the case of specimen 53-B there were in addition to the lines of red PbO and metallic Pb three exceedingly faint lines, which extended only part way along the width of the diffraction pattern, and I have

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called them "partials" in my report, to show that they did not extend the full length that would have been expected from a true diffracted line. I have labeled in my report the intensities of these three lines as follows; v. v. v. v. f. partials; may be imagination. In other words, I was trying very hard to be sure that I had put in everything that I could see, or anything that I could even imagine I could see. These three lines corresponded to the following interplanar spacings: 2.35, 2.20, 2.10.

I am not sure that those three lines are actually present in the film. If they are present in the film I don't know what material they correspond to. In any case, in neither the diffraction pattern of specimen 53-A nor in the diffraction pattern of specimen 53-B did I find any lines corresponding to those which have been attributed to this so-called compound, Pb_2O.

By Mr. Morris:

Q. Have you your films showing the lines for these respective exhibits?

A. I have.

Q. Will you present them?

A. In addition to those films I have prepared certain charts for the convenience of the Court, which are easier to see than the films, and if the Court pleases I should be glad to show the Court—

The Court: Yes.

A. —the charts.

The Court: Yes, I can't read the films.

The Witness: Excuse me, I didn't hear you.

The Court: I can't read the films. Let me have the charts. Oh, you have got them there?

(The witness produced the charts.)

THE WITNESS: These are taken directly from the films, and after they have been drawn have been checked carefully by myself with the films themselves, and an exact correspondence has been found.

In the case of the first two charts I have indicated the intensities of the lines roughly by the heights of the lines on the chart for the metallic lead and for the red PbO, that is, metallic lead from the International Critical Tables, and the red PbO. For subsequent charts I have not done that because the material seemed to be identical, and it did not look as though it would be worth while to try to indicate lines, intensities of lines which were identical on the two halves of the film.

By MR. MORRIS:

Q. Now, will you present your films and tell me when you produced them and what they represent?

MR. MORRIS: Does Your Honor want to take time to examine any of these films over a reading box? I don't suppose you do.

THE COURT: I don't think so, no.

MR. MORRIS: I wouldn't think so.

THE WITNESS: This is going to take a little time.

MR. MORRIS: All right.

(Discussion off the record.)

MR. MORRIS: I offer in evidence as Defendant's Exhibit 137 a copy of the chart referred to by Dr. Davey.

(Chart prepared by Dr. Davey was marked Defendant's Exhibit number 137.)

THE WITNESS: There are in addition, I think, one or two charts on the end of that tabulation. I say, there are one or two charts on the end of that tabulation, which I have not yet taken up.

By MR. MORRIS:

Q. Are they on this, too?

A. Yes.

Q. You don't want to say anything about those now, or do they come in answer to something else?

A. They will come immediately.

MR. MORRIS: Let it stay in as part of 137, and we will deal with that later.

THE COURT: Where is the color chart of the plaintiffs'?

By MR. MORRIS:

Q. Dr. Davey, suppose we pass the film, the question of your films for a moment. Then we will conclude your examination without introducing the films. Then when you are off the stand you can introduce these films and classify them.

A. That will save a great deal of time.

Q. Dr. Davey, can you tell me how small a quantity of another lead compound you could have discovered by your X-ray methods if such additional lead compound had been present in the mixture?

A. I can.

Q. And on what grounds do you base your answer to that inquiry?

A. I wanted to find out how small a percentage of this so-called Pb_2O I could have found if any such material had been present. I had no Pb_2O. As far

as I know, no one else has ever had, and so I had to get a proxy for it. The proxy was the Electric Storage Battery Company gray oxide, which was largely red PbO. Having used red PbO as my proxy for the so-called Pb_2O, I used the yellow PbO as a proxy for all of the rest of the material in the samples. I made up mixtures with known percentages of the gray oxide in the yellow PbO, and I found that I could detect one per cent of gray oxide in yellow PbO with certainty, that I could not detect a tenth of one per cent with certainty. Somewhere between a tenth of one per cent and one per cent is, therefore, the limit of accuracy for determining the presence of a small amount of some other lead compound in the presence of the oxides of lead.

Q. Do you have some data with respect to that on your Exhibit 137, Defendant's Exhibit 137?

A. I have.

Q. Does it need interpretation by you, or is it self-explanatory?

A. I think it is self-explanatory. In my chart 13 I show the diffraction patterns of red PbO, the one per cent mixture of gray oxide with ninety-nine per cent yellow PbO, and yellow PbO alone.

(Discussion off the record.)

THE WITNESS: Will you please read my answer?

(The answer was repeated by the Reporter, as follows:

"In my chart 13 I show the diffraction patterns of red PbO, the one per cent mixture of gray oxide with ninety-nine per cent yellow PbO, and yellow PbO alone.")

THE WITNESS: Yes, I have read PbO alone, yellow PbO alone, both for purposes of identifying the positions of the lines which belong to them. I have the mixture of one per cent gray oxide and ninety-nine per cent yellow oxide, and the presence of the gray oxide is quite evident in the diffraction pattern of that test sample.

I have similar tests for higher percentage, namely, five per cent gray oxide mixed with ninety-five per cent yellow oxide.

Would the Court like to examine the charts for those, to show—

THE COURT: I am going to get their set of charts.

THE WITNESS: That completes the series of charts which I have made.

By MR. MORRIS:

Q. Does that conclude your answer to the question, Dr. Davey?

A. It does. I could have determined as much as one per cent of an extra lead compound in the gray oxide, if it had been present.

Q. Now, then, am I right in this summary, that you did examine defendant's product, —

A. I did.

Q. —and you found no lines on your films in any way corresponding to the alleged Pb_3O lines? Am I right, or not?

A. That is correct.

Q. Is the same thing true with respect to what you subsequently discovered was the Toronto product?

A. That is correct.

Q. And your last statement, as I understand it, is that if there had been a lead compound, other than

the ones that you have mentioned, in any of your products, at least in a quantity equal to one per cent, your tests showed that lines therefor should have appeared on your films, or not?

A. That is correct.

Mr. Morris: Direct-examination closed.

Cross-examination.

(Discussion off the record.)

By Mr. Whitcomb:

Q. Which type of X-ray apparatus do you regard as more accurate, using the type that Dr. Clark used, or yours, on the target material?

A. An answer to that question must imply a knowledge of what the apparatus is to be used for.

Q. Well, for the purpose of this case.

A. I can illustrate that by saying a horse is more useful in some cases—

Q. I say for the purpose of this case.

A. —and a cow in other uses.

Q. Of course, I am not asking about some other case.

A. For the purpose of this investigation an ideal situation would be obtained—

Q. Well, I am asking which—

A. —by using both.

Q. —which is most advantageous; are they the same?

Mr. Morris: He has answered it. He said both.

The Court: Well, that really is not an answer. He asked which one is the more accurate—

Mr. Whitcomb: Accurate.

THE COURT: —and more advantageous for this thing.

MR. MORRIS: But may I call Your Honor's attention to this? Dr. Davey has used a molybdenum one. We are going to show by Dr. Anderson that he used a copper one. I wonder if the light of that which I promised to bring out whether his answer to that is not a perfect answer.

THE COURT: I don't think so, Judge. I think he can say whether this one is better than the other for the purpose of this case. If he doesn't think there is any difference he can say so.

THE WITNESS: For the investigation of larger interplanar spacings the copper characteristic rays are better. For the investigation of a very small interplanar spacings the molybdenum target X-rays are better.

By THE COURT:

Q. Well, which is your investigation directed to? Are these large or small interplanar spacings in the PbO?

A. I have put all on there that I have been able to find from the diffraction pattern and read with certainty.

Q. Yes, but do you call them large or small?

A. Some of them are large and some of them are small.

Q. And the interplanar spacing, does that have reference to the distances between these lines,—

A. No.

Q. —or is it something else?

A. Interplanar spacings are distances in the crystals calculated from Bragg's Law, which includes

the wave length of the X-rays, the radius of the curved photographic film, and the distance from the reference line to the line of the diffraction pattern. In my charts the left-hand line of the whole chart is the reference line.

Q. Well, all right, all I want to know, all I can get out of that is that the distances between these lines on your charts have nothing to do with interplanar spacing.

A. Not the distances between lines,—

Q. No.

A. —but the distance from here, from the most left-hand line to each of the lines.

Q. Yes.

A. That total distance for any one line is calculated back to show the distance between planes of atoms in that crystal.

By Mr. Morris:

Q. Can you make a short statement, one sentence, of your theta angle by reference to the reflection of light, or does that take two minutes? If it does, don't do it.

The Court: Oh, I can read it in a book, I guess, if I have to.

The Witness: It will take longer than one minute, yes.

Mr. Morris: All right.

By Mr. Whitcomb:

Q. Will you please produce the data and work sheets you used in transforming the film material to this chart you produced, Defendant's Exhibit 137?

A. I have somewhere four laboratory notebooks, not loose sheets, but bound notebooks. I thought that

I had them with me in this case. I am very sorry, I thought I had my laboratory notebooks with me; they are down in the hotel, apparently.

Q. Well, you will get them and produce them?

A. Certainly.

Q. Now, I understand—

A. I can give you substantially the same data, though, from my written reports.

By The Court:

Q. Now, before you do that will you tell me why, Doctor, it is what you told me before, but I think you might as well have it on the record, why Dr. Clark's photograph of the film for Pb, which is under number 2 on his Exhibit 21, shows, as I count it, about twenty-three or twenty-four plainly visible lines, and your chart for Pb shows only nine?

A. The different is due to the total exposure on the film. If I had exposed my film a longer time I could have shown still more lines.

Q. Well, are all his lines—

A. I contented myself with showing enough lines to identify the material.

By Mr. Whitcomb:

Q. Then you have not exposed your films long enough, is that right?

A. I have exposed my films long enough to get a sufficient diffraction pattern for identifying the material.

Q. But if there was anything else in there you didn't find that out?

A. Further exposure would have made very little difference in this case, because the intensity of the diffracted beams decreases as the angle of diffraction is increased.

Q. Did you try it?

A. What do you mean?

Q. Have you ever tried to make a longer exposure?

A. Certainly.

Q. When? In connection with this case?

A. In connection with this case.

Q. Yes, when?

A. It is a matter of ordinary experience.

Q. Well, when did you do it?

A. Tried to take a longer exposure?

Q. Yes.

A. I have taken exposures so long that it was—that it gave a fogging, a general fogging of the film.

Q. Will you produce your records and data sheets that you used in connection with that?

A. I can. I have already told you that my laboratory notebooks unfortunately have—

Q. Oh, they are in the same notebook?

A. Certainly, and I have the films which show it, which have been promised to be introduced in evidence, as soon as I get time to sort them out.

Q. Now, as I understand it, your powder was placed in glass tubes, is that right?

A. Correct.

Q. And you heard Dr. Clark testify that his was not placed in a tube, is that right?

A. I did.

Q. In your opinion what effect would the tube have,—

A. The tube tends to increase—

Q. —in contradistinction to the other?

A. The tube tends to increase the general fog somewhat.—

Q. So your film—

A. —and the material—wait a minute.

Q. —could not be as clear as the other?

A. Wait until I finish—and the tube tends to cut down the intensities of the lines, especially those of higher interplanar spacings.

The wedge technique I suppose is subject to the exact materials used in forming the wedge. I have no knowledge of what kind of a mould the wedge was made in, so that I cannot tell whether there was any contamination from the wedge, or not.

Q. Assume that it was just placed in the little cradle that held the wedge, without any mould.

A. No, I mean in making the wedge itself, in the first place, I don't know what moulding material he used, so that I can't tell whether there was any contamination likely from that or not.

Q. Is it necessary to use any moulding material?

A. You can't make a wedge without pressing something together, can you?

Q. In this case my information is that it was done without any moulding material whatever.

A. Do you mean to say he took a powder and made a wedge out of it without pressing it against anything?

Q. He didn't use any moulding material in the wedge.

A. That is not what I am talking about. I am saying any material used as a mould.

Q. How long did you expose your samples to the action of the X-ray.

A. Anywhere from eighteen hours up to about three days.

Q. You understood that Dr. Clark testified that his were an average of about an hour, I believe, is that right?

A. Yes, with some going up to three hours.

Q Do you think the longer exposure would have

any different effect in your tests, as compared to those in which a short test is made?

A. If so, such effect is not now known.

Q. Well, if there were Pb_2O, or a suboxide, whether you call it strictly Pb_2O, and it does have this fugitive characteristic, were you to take eighteen hours to make a test would it not be possible to change from one composition to another during that time?

A. I suppose we have about the same chance of getting a change that we have in the official sample introduced by the plaintiff in that test tube, which has certainly been—

Q. Well, there is a chance?

A. —more than eighteen hours in the test tube, with just a couple of corks to keep the air out.

Q. Well, then, there is a decided chance of change, is that right?

A. I said about the same chance as that sample, which has been submitted as evidence of being pure Pb_2O.

Q. Well, did that have a decided chance of change?

A. That I can't tell, because I don't know that it is Pb_2O. If it is Pb_2O I don't know the properties of Pb^2O_2 except from hearsay—

Q. Well, making the assumptions—

A. —for what it is supposed to be for the supposititious compound.

Q. Making the assumptions I just made when I started this line of cross-examination, what have you to say on that? In other words, you think that Dr. Clark's sample might have changed as he brought it from Illinois here?

A. If it is as fugitive a substance as he has claimed, and as Ferrari has claimed, I suppose the burden of proof is on him that it did not change.

Q. Well, I am asking you what you thought,—

A. I haven't qualified—

Q. —your opinion?

A. —as an expert on Pb_2O. I have never seen any.

MR. WHITCOMB: Your Honor, I mean, you see, we are making certain assumptions.

THE COURT: Well, what you want to know, as I understand it, is whether there was a—I don't know, but—

MR. WHITCOMB: I asked him if he thought there would be a change during the time of taking his exhibits.

THE COURT: Yes, he hasn't answered that question.

MR. WHITCOMB: He hasn't answered.

THE COURT: That is really the question we got off on.

By THE COURT:

Q. Do you or do you not think that oxidation took place during the taking of the pictures in your experiments?

A. I do not think any oxidation took place during taking of pictures in my experiments with the official samples. I am sure that it could not have taken place with my samples—

Q. With the lead balls?

A. —with the lead balls—what were they, 83-A and B?

Q. 53-A.

A. 53-A and B.

THE COURT: That is what you wanted to ask, Mr. Whitcomb?

THE WITNESS: Because there was no oxygen present by which—no free oxygen present by which they could be oxidized.

As for the general case I can't say, because the only interpretation I can make of your question is, if it is an unstable compound would it be likely to be decomposed? The answer is obvious; if it is an unstable compound it would be likely to be decomposed.

By THE COURT:

Q. What happens to your X-ray film if you are examining an unstable compound that decomposes during the period of exposure? What sort of a film do you get?

MR. WHITCOMB: Where it is eighteen hours.

THE COURT: Yes, I am not referring particularly to lead, because I realize that you do not agree that there is any Pb_2O, but take an unstable compound. I suppose there are other unstable compounds—

THE WITNESS: I can illustrate—

THE COURT: —that will decompose in air.

By THE COURT:

Q. Now, suppose you expose them to your X-rays, and while that is going on they change their character; what happens to your film?

A. I can illustrate that in terms of some experiments that I made many years ago, on the halides of silver. Silver chloride is decomposed supposedly—

Q. Well, that might take too long.

A. —by either light or X-rays,—

Q. That might take too long.

A. —and then I was able to—

Q. Can you tell me briefly—

A. —get a diffraction pattern of the silver chloride—

Q. What?

A. I was able to get a diffraction pattern of the silver chloride with the molybdenum rays.

Q. That was the original thing?

A. I was able to get a diffraction pattern of silver chloride itself, in spite of the fact it is supposed to decompose slowly under the action of the X-rays.

THE COURT: All right.

By MR. WHITCOMB:

Q. When you placed your samples in the tube was there any water formed?

A. Will you please read that again?

Q. You, as I understand it, you took some of this powder and put it in a tube to make your X-ray examination, is that right?

A. Yes.

Q. Now, is there any formation of any water during that procedure?

A. No, there wasn't—I suppose you mean was there any visible water present; there certainly was not, or we could never have loaded the tubes.

Q. Did you seal the glass?

A. The glass was sealed with wax. In the case of the specimens 53-A and 53-B the glass was sealed with a very special wax, which we call Penn State wax.

Q. But as to the others, you did not seal them under nitrogen, and you had the contact with the ordinary room atmosphere, did you not?

A. Yes, they were sealed—

Q. Any moisture in the air would—

A. They were loaded in air and sealed in air.

Q. And any moisture in the air would have been trapped in the tube, is that right?

A. Any moisture would have been trapped in the tube as moisture, not as liquid water, with the same proportions—

Q. Was it H_2O?

A. —that would exist in the room at the time.

Q. Was it H^2O, whether it is moisture or water, are you trying to make a distinction?

A. Within the meaning of your question I should say, yes.

Q. Was the background of your films clear enough to see faint lines?

A. Yes.

Q. Was it as clear as it would have been if you had not had to use the glass tube, and had not had to have it exposed as long as you had to have it exposed?

A. Theoretically, no.

Q. Did you make any microphotometer examinations such as—

A. No, ordinarily they are not very useful.

Q. Have you any machine for making them?

A. We have.

Q. And why do you regard—

A. I have never been able to find anything with a microphotometer which contributed more real information than I could get by visual inspection of the film. It is a matter of common knowledge that the absolute intensity of a line on a photographic film of a diffraction pattern means very little, it is only the relative intensities which count, and the relative intensities can usually be determined with sufficient precision by visual inspection.

Q. How about the actual position of the weak lines, for example? Doesn't the microphotometer bring that out?

A. With interplanar spacings of approximately 100 or less I have no trouble by visual examination in locating the interplanar spacings within one part in a thousand.

Q. But I am asking you whether or not the microphotometer will bring them out clearly.

A. They will bring them out visually, but they are visual on the film, at any rate.

Q. Well, are there any lines that might have been faint and not visible that would have been brought out by the microphotometer? Is your testimony that the microphotometer would not bring out any lines that were otherwise faint and difficult of visual inspection?

A. My answer to that, I suppose, would have to be that we are all human, and that any human being is likely to fall into error, but by visual inspection I can determine, as I have already testified, the presence of an additional lead compound of concentration down as low as one per cent.

Q. Yes, but, now, will you answer the question?

MR. WHITCOMB: Please read the question.

(The question was repeated by the reporter, as follows:

"Q. Well, are there any lines that might have been faint and not visible that would have been brought out by the microphotometer? Is your testimony that the microphotometer would not bring out any lines that were otherwise faint and difficult of visual inspection?")

A. The microphotometer will bring out anything that is on the film, including fly specks and scratches.

By Mr. Whitcomb:

Q. And, therefore, is it a more accurate method than mere visual inspection?

A. Possibly a more accurate method for photometry of fly specks and scratches, but not of determining diffraction patterns.

Q. Then in your examination reliance upon visual inspection alone is the only thing you used to detect the absence or presence of faint lines?

A. Yes, sir.

Q. Did you use anything to magnify the lines?

A. I did.

Q. What?

A. A lens.

Q. What degree of magnification?

A. It was an ordinary reading glass.

Q. How many samples have you examined for this case?

A. I don't remember exactly; I should say over a hundred. I assume that your question means total number of samples, irrespective of whether they were official samples, or what?

Q. Yes, just some idea.

A. Somewhere in the general neighborhood of a hundred.

Q. Will you produce the work sheets for your work on that?

A. I can.

Q. They are in the same books?

A. They are in the same notebooks of which I have spoken.

Q. Do those books contain all the work sheets and data sheets that you have—

A. Correct.

Q. —relating to the case?

A. Yes, sir.

Q. Please explain whether or not in connection

with those ball samples you mentioned you attempted to examine it layer by layer.

A. We did not.

Q. Dr. Clark's films are about how long?

A. On a guess, I should say about six inches long.

Q. Have you got a slide-rule there?

(A film was shown to the witness.)

A. No, I do not, I have no kind of rule. Now, when you asked for the length of his film do you mean the total length of the photographic material supplied by the Eastman Kodak Company, or do you mean the length of film which is used in making a diffraction pattern?

By Mr. Whitcomb:

Q. The length of film used in the diffraction pattern.

(A rule was handed to the witness.)

A. Conditions of illumination are not at all ideal here, but I should say that he had five and one-half inches of useful film.

By Mr. Whitcomb:

Q. And how long is the slide-rule on which you made the tests that you put photographs of in evidence yesterday?

A. Twenty inches, of which about ten inches was useful.

Q. Well, then, in attempting to make those checks that you made any possible variations from the pattern were magnified in that ratio, —

A. The reason—

Q. —is that right?

A. —for using the long slide-rule was because it was impossible with an ordinary, soft lead pencil to mark the lines on the slide-rule with the precision with which the lines appeared to be on the film.

Q. But, nevertheless—

THE COURT: Well, but, now, he asked you a pretty simple question.

THE WITNESS: Excuse me, Judge. I thought I was answering it.

THE COURT: Will you read it to him, Mr. Rodebaugh?

THE WITNESS: I thought I was answering. Will you repeat the question?

THE COURT: No, I don't think you were, because the question could be answered by one word. Just read the question.

THE WITNESS: I am sorry, I have misunderstood the question, then.

THE COURT: All right.

THE WITNESS: Will you please read the question to me?

THE COURT: The question is whether—well, read it to him.

(The question was repeated by the reporter, as follows:

"Q. Well, then, in attempting to make those checks that you made any possible variations from the pattern were magnified in that ratio, is that right?")

THE COURT: That is, of five to ten.

THE WITNESS: Now, in order to answer that question I must—I must find out what Mr. Whitcomb has in mind. Does he have in mind the magnification assuming that the marks on the

slide-rule were geometrical lines, or does he have in mind the over-all accuracy of the comparison, taking into account the width of the pencil marks on the slide-rule?

By Mr. Whitcomb:

Q. Well, when you measure an original film do you measure it to a geometrically perfect line, or don't you have to make a visual estimate of the best point to take the measurement?

A. I make a visual estimate of the correct point to take.

Q. So there is a human error there, as well as in connection with making the pencil mark.

A. But in making a pencil mark on the slide-rule, using an ordinary Eversharp pencil, it is very difficult to get the line placed to much better than a half of the division between spacings on the slide-rule. The width of the pencil mark is just about as wide as the spacing between two adjacent marks on the twenty-inch slide-rule.

Q. But regardless of that, the ratio of the length of the film, of about five inches to ten inches on the slide-rule, had the effect of multiplying by two any possible variations from the fixed pattern, isn't that correct?

A. It would have multiplied the variations by two if I could have marked my pencil marks with infinitely narrow markings, but with the width of pencil mark which I had, the uncertainty of the pencil mark was brought on that twenty-inch slide-rule to about the uncertainty of the measurements of the diffraction pattern.

You see, we must determine in all of these cases not absolute accuracy, but percentage accuracy, and the width of the pencil mark made my percentage ac-

curacy as I estimate it on the twenty-inch slide-rule about the same as the percentage accuracy in Professor Clark's data.

Q. Well, what did you mean when you say that his measurements for the metallic lead were within a quarter of a per cent accurate? You checked those with a pencil, did you not?

A. Yes.

Q. Well, what is your measurement, quarter of a per cent accurate? That is not inaccurate by more than one-quarter of one per cent, as I understood your testimony?

A. I mean that the pencil mark would not have to have been moved to a new reading differing by more than a quarter of a per cent from the actual reading to have made an exact match of the theoretical lines. That is work of considerable merit.

Q. Well, but couldn't—

A. I congratulate Dr. Clark on having such good diffraction patterns of metallic lead.

Q. But couldn't a point be, say, an inch out of the way, or a line, and then if you moved it the width of the pencil is that still only a quarter of one per cent error?

A. Now, if I understand your question correctly, you have asked me whether it would be possible on that slide-rule to have moved a line an inch and got it—got the error only a quarter of a per cent?

Q. So far as your measurement—

A. Certainly not. An inch on the slide-rule represents much more than a quarter of a per cent in the region which I specified for the measurement of percentage accuracy.

Q. How much error does an inch represent?

A. What say?

Q. How much error does an inch represent?

A. I should have to get a slide-rule to tell you, but I assume it would represent—

Q. Well, get one—

A. —an error—

Q. Get one and tell me.

A. An error of probably twenty per cent—excuse me, don't take that answer down, I will take a slide-rule and I will find out.

Q. In other words, we are trying to get at your measure of the scale of the inaccuracy or accuracy. I would be glad to have you state the basis of your determination of such percentages. Will you do so?

THE COURT: Well, I think we will recess for ten minutes while he is working on that.

(Recess at 11:25 o'clock A. M.)

WHEELER P. DAVEY, recalled.

Cross-examination (Continued).

By MR. WHITCOMB:

Q. Were you able to give us the basis—

THE COURT: Did you find that chart for me?

MR. WHITCOMB: No, sir.

THE COURT: I want that one. I don't remember having it over there.

(Discussion off the record.)

THE COURT: Well, all right. There is no use wasting time on it. You could make another one for me, I suppose.

By Mr. Whitcomb:

Q. Were you able to give us the basis of your percentage of variation that we were talking about?

A. You asked—

Q. The basis of your percentage of variation—the estimated percentages.

A. The basis?

Q. Yes.

A. I have not made the estimate. I have—

Q. Go ahead. You made the estimate of one-fourth of one per cent.

A. The last thing was about an inch.

Q. All right.

A. In the region of the slide-rule for which I made the estimate of a quarter of a per cent error in Dr. Clark's work, thereby showing the extreme accuracy of his diffraction pattern of lead.

In that same region, the displace of—the displacement of a line by an amount of one inch would have made an error of twelve and a half per cent, or over fifty times the experimental error in Dr. Clark's diffraction patterns for lead.

Q. How small an amount of substance could you determine by your method of X-ray analysis?

A. I have already testified that for lead compounds in the presence of other lead compounds I could detect one per cent.

Q. If a colloidal substance is present—an extremely finely divided substance—could you find it in this percentage that you said was your limit or the limits of your ability to detect a substance, if it was, say, one per cent?

A. The answer will depend on what you mean by finely divided substance. Of course, it is possible to have a substance, even a crystalline substance, so

finely divided that the Bragg's law for diffraction begins to fall down, and for such a material the lines get to be very diffused, and if they are very weak to begin with and then that weak intensity is spread out over a greater area over the film it becomes much harder to see.

Q. And you would not be able to detect it by your method, is that what you mean?

A. I mean that if you had a material of sub-colloidal dimensions it would be very difficult to detect it in any reasonable percentage.

Q. Referring to Plaintiff's Exhibit 21—you have one there—how would you measure the line sub ten for pattern number 10, or, rather, which is the third from the left-hand side?

A. Counting that by means of the dots—dots, do you mean?

Q. No, I mean, how would you measure the line from the center in making measurements, when you consider the pattern number ten on this exhibit ten?

A. I am still inquiring the meaning of your question, Mr. Whitcomb. Do you mean the third line as represented by the third light dot at the bottom of the line, or do you mean the third thing I could imagine was a line, or what?

Q. I mean leaving out the dots and looking at it—here (indicating), you see? It seems to be the first line, the first strong line; the next one is rather weak or the next one is rather broad. Where would you undertake to measure that third line?

A. It is very difficult to answer in terms of a print because we always work on photographic film. If I had the photographic film, I could give a much more intelligible answer.

MR. WHITCOMB: Will you get the film?

MR. SCHAFFER: Yes.

(Discussion off the record.)

By MR. WHITCOMB:

Q. Change that question to the fourth line from the left-hand side. Here's the film for pattern ten on Exhibit 21 (tendering).

A. Are we going to speak of the same line? Now, I see here one line—do you see that?

Q. No.

A. It's at the corner there (indicating).

Q. Let me pick it out on this.

A. Suppose you put a mark on the film.

Q. I can't do it on the film, but here it is on there.

THE COURT: I will have to ask you to suspend here for a minute.

(Discussion off the record.)

THE WITNESS: I have your film number 94-B, suboxide.

By MR. WHITCOMB:

Q. Exhibit 28-A.

A. I am told now that the line about which I am asked is no longer the fourth line. It is actually the eleventh line.

Q. No, sir; I beg your pardon.

A. Yes, it is; and it is marked with a dash in ink, and I am so informed by Dr. Clark himself that that line there is not the fourth, but it is very evidence it is the eleventh.

THE COURT: Do you agree to that, Doctor?

DR. CLARK: All right.

THE COURT: All right, call it the eleventh. It's the one marked with a dash.

THE WITNESS: It is the only one on the film marked with a dash.

MR. WHITCOMB: All right.

THE WITNESS: With a wide line like that, it is my custom to make a reading at each edge of the line, thereby indicating the total width of the line and indicating the peak of the line limits, somewhere in these two limits.

By MR. WHITCOMB:

Q. In that case, it is micrometer—

A. No. And it gives an average blackness over the long length of the slip through which the light travels, if there should be an especially dark spot, which I have indicated by means of a fly speck, although I don't intend to limit myself to a fly speck. If there should be a small black spot somewhere on that film, the micrometer will register exactly the same as if it is a weak line extending all over the whole range of the micrometer slip.

Q. You measure both sides?

A. Yes, I measure both sides of the bands—the sides of the bands.

Q. Then, for that particular line, it would be accurate to scale if it was anywhere between those two?

A. No.

Q. Why not?

A. Because a single reading on a band does not represent the fact that it is a band and does not represent—it does not represent anything by which we can interpret the band.

Q. But, if I took a certain measurement and said that that was the line, and it came between that band,

would you swear positively that that wasn't the line for that particular diffraction and accurately represented that particular diffraction?

A. Well, if you gave me a reading to three decimal places of this line or to two decimal places of this line, without my having seen the film, I would assume that you had measured to within the precision indicated by three decimal places or two decimal places.

Q. I am not talking about reading; I am talking about plotting a line and having drawn the line.

A. I am assuming that you are referring to my plotting the lines on the slide-rule?

Q. Something like that.

A. I plotted the data which had been submitted in evidence—

Q. I am asking you—

A. —and I had no photographic film by which to check the data. I took the data as they were offered in evidence.

Q. I know, but we want to get along with the case. Now, I am asking you if I took a line from there, or if you take a line—I will ask you to take a line, and if you don't take it in either the beginning or at the end of that band, but you specify it in between. That still represents the diffraction for that particular substance from that X-ray, does it not?

A. If I were plotting a band of this sort on a slide-rule, I would plot the two limits of the band and come between the two lines—connect between the two lines of the slide-rule, to show that it was on the band. That is my standard practice.

Q. Is it possible, in your opinion as a scientist, to take measurements from the film which would produce lines which were actually—which would actually fall within the face-centered cubic pattern from any of these films?

A. I have already shown by the slide-rule method that it was possible to find from Dr. Clark's measurements submitted in evidence a diffraction pattern for load which did match the face-centered cubic pattern within one-quarter of a per cent, which I regard as a very high degree of accuracy in individual lines, and—

Q. Now, is it possible—

A. —he is to be complimented on his work.

Q. —for the measurements, bearing in mind this testimony that you have just given about a broad band, or to make lines from these films which would produce a cuprite structure or the latticework shown by Dr. Clark in his Exhibit No. 29, which he has labeled Pb_2O?

A. It is impossible to answer such a question without actually making measurements on the photomicrometer film and planning out what the limits would be. What I plotted and offered in evidence is the actual date submitted by the plaintiff. There was nothing on the data sheet to indicate whether it was a band or a line. I just took—I took just whatever the plaintiff submitted as evidence.

Q. We have submitted the films as evidence. Why didn't you refer to the film?

A. I referred to the data sheet. Why should I take the time of the Court and hold up all the proceedings—

Q. Because it will probably help the plaintiff, that's why.

A. —for weeks to get the data when the data sheet was already submitted.

Q. Please refer to your Exhibit D-137. Have you got it?

A. No. I don't even know what it is.

Q. Well, that's a copy (tendering), or do you

want the original? No, you have the original right in front of you.

A. I assume this is what you are talking about.

Q. Is this the original?

(Discussion off the record.)

By Mr. Whitcomb:

Q. Please refer to page two of this exhibit—the lines that I have marked in red—and state why that appears to be, or does not match?

A. The chart to which my attention is referred has to do with the comparison of the diffraction patterns or a mixed—or a mixture of—a mechanical mixture of lead and red PbO, with a diffraction pattern of Eimer and Amend lead, finest powder.

By The Court:

Q. That's chart number two?

A. It is chart number two.

Q. The first one up there?

A. Yes.

(Discussion off the record.)

The Witness: I have been asked to explain why the next to the last line in the upper row of lines of that chart does not match the next to the last line of the lower row. Each of those lines was probably present in the diffraction patterns, but it sometimes happens that the orientation of a particular crystal plant is missing in a powder, so that it is—excuse me, just withdraw that answer, and I will start again.

By Mr. Whitcomb:

Q. Well, I think it—all right.

A. It sometimes happens that there are not as

many samples of a particular orientation in the powder specimen for one specimen as there may be for another powder specimen, and so it will turn out that sometimes you will get a line and other times you may not get that same line for a diffraction pattern. Now, I am not speaking here on anything except an individual line in a sequence of lines. Now, it can be shown by comparing this chart with other charts that the next to the last line in the upper row of lines matches the diffraction pattern previously found for a mechanical mixture of red PbO and metallic lead.

Q. Where can you show that?

A. If you will let me take that chart which you just borrowed, on the tracing cloth.

Q. Here it is. Well, isn't this a duplicate of what you have in your hand?

A. This is a duplicate of that, yes, but I want to show you the transferences. Now, you will notice—let me see, I will get that this way—that, on that upper row of lines, one is a red PbO line. Are you satisfied as to that?

Q. Well, you go ahead and give your complete answer.

A. All right, let me give a complete answer. (Exhibiting.) I am matching the Chart No. 1, Specimen No. 13, Film 5, with Chart No. 2, Specimen No. 8, Film 3-A, and find that the next to the last line on the upper row—excuse me, this is off the record. Did I say Chart No. 2, Specimen 8, or did I say Specimen No. 11?

(The Reporter then repeated the following:

"A. . . . I am matching the Chart No. 1, Specimen No. 13, Film 5, with Chart No. 2, Specimen No. 8, Film 3-A. . . .")

THE WITNESS: Now, then, if you will please read the rest of it so I can get the continuity.

(The Reporter then repeated the following:

"A. . . . and find that the next to the last line on the upper row—")

THE WITNESS: —on the upper row corresponds to the line or to a line in the diffraction pattern of red lead.

I am now comparing Chart No. 1, diffraction pattern of metallic lead from the International Critical Tables, with Chart No. 2, Specimen 11, Film 3-A, and find that the next to the last line matches a line from the diffraction pattern of metallic lead.

I have already testified that the Eimer and Amend lead, finest powder, represented on the lower set of lines of Chart 2 shows the presence of both Red PbO and of metallic lead.

I have already testified that the upper row of lines represents the mechanical mixture of metallic lead and red PbO.

One of those displaced lines belongs to the lead pattern; the other belongs to the PbO pattern; and, therefore, it is not to be expected that those two lines will necessarily register.

In answer to your question, I could say that one of the lines from red PbO is missing on one of the series of lines of Chart 2 and that one of the lines of metallic lead is missing from the other.

By MR. WHITCOMB:

Q. Well, please refer to page four of your charts, Chart 8, and explain the difference between the group of two lines, third end from the right-hand side. Can you see it there (indicating)?

A. I see it, yes.

Q. All right.

A. One of my reports seems to be missing, from which I wish to go back to the original data to discover the details of that, of those lines. I had that report here just a few minutes ago.

Q. In this case, there is a discrepancy that you want to explain. Is that right?

(Discussion off the record.)

By Mr. Whitcomb:

Q. Before you refer to your notes, will you answer the last question?

A. Will you please give me the last one?

Mr. Whitcomb: The stenographer will please read it.

(The question referred to was then repeated by the Reporter, as follows:

"Q. In this case, there is a discrepancy that you want to explain. Is that right?")

By Mr. Whitcomb:

Q. Dr. Davey, will you answer that one?

A. I wish to refer to my notes and refresh my memory in order that I may answer your previous question correctly.

Q. Well, that still does not answer my question. Is there or is there not a discrepancy that you want to explain?

A. There is a displacement of the lines. Is that what you mean by discrepancy?

Q. The lines do not match?

A. If that's the interpretation of your question, the answer is yes.

Q. Then, will you proceed to do so?

A. I find from my report that the tenth line in

both rows of Chart 8, taken from Film 16, represents a line so faint as to be barely on the limits of visibility. I have labeled the intensity of this line very, very, very faint—in code, v. v. v. f. That's my code for a line whose intensity is so small that it is barely possible to see it and still be sure that it is actually there.

The order of accuracy of the reading of such very faint lines is low. I have recorded the positions of those lines, but I am not at all sure that those recorded positions are correct because the intensity is so low. They represent my best judgment in reading the film for those two individual lines.

Q. What about the eleventh line from the left-hand side?

A. It is the eleventh line that I thought I was talking about. Didn't I say the eleventh?

Q. I thought you said the tenth.

A. Excuse me. If I said tenth, I meant the eleventh. The tenth line is obviously registered on the chart in spite of the low limit of accuracy of the reading.

Q. Now, refer to page three of your Exhibit 137, chart—two charts—and state whether or not the last line in the lower one, No. 5, matches with the one above, No. 7?

A. It does not, quite.

Q. Why is that?

A. It was the last line which I was able to read with anything like certainty on the photographic film. The further toward, to the right, you go—to the right in the photographic film you go in your readings in general, the fainter the lines get to be. This was the last one I was able to read with certainty. The order of accuracy of reading those lines, except under the most favorable conditions, is not as high as for the other lines.

I should like to call your attention, however, to the fact that there is a systematic match between the lines of the upper and lower row on that same chart. Except for that last line—that's one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen—thirteen lines show a match.

Q. Are you acquainted with Le Blanc's work?

A. Somewhat.

Q. I hand you a pamphlet and call your attention to Figure 5 on 137, and ask you to state whether or not those two patterns there match?

A. My answer will have to be qualified by the assumption, or by an assumption, as to the precision of readings represented by the lines on this Figure 5, about which my opinion has been asked. If these two diffraction patterns represent precision readings, taken with the proper calibration material in the customary way, then the match is not too good. If they do not represent precision readings, there is no possible way of deciding whether the match comes within the limits of precision of the data or not, without going back to his original note book records.

Q. Well, aren't you justified from the data there, that is given there, justified in concluding that those two materials are identical—assuming the degree of accuracy that any scientist would use in publishing a pamphlet, bearing also in mind the reputation of the writer?

A. I assume that the author intends to convey that, within the precision of his experiments, he gets a substantial match between his diffraction pattern for red PbO and his diffraction pattern for the so-called Pb_2O.

Q. And yet the lines do not match within the meaning of your general testimony about the matching of lines. Is that right?

A. In that case, "his" means the author of this article in which the figure occurs that has been brought to my attention.

Q. Will you answer my question?

A. Give me the question again, please.

(The question was then repeated by the Reporter, as follows:

"Q. And yet the lines do not match within the meaning of your general testimony about the matching of lines. Is that right?")

THE WITNESS: They don't match within the precision of the measurements which I have tried to show on our charts.

By MR. WHITCOMB:

Q. Now, refer to another figure in this pamphlet.

THE COURT: Let me see that a minute, please.

(Discussion off the record.)

MR. WHITCOMB: Although these do not match, the pamphlet says they are the same thing, showing what an outsider does and how near they may come.

THE COURT: What is the effect of this?

MR. WHITCOMB: We will show that some of those patterns of Dr. Clark's that do not match—that will justify the conclusions of Dr. Clark.

THE COURT: Oh, you are not talking about this?

MR. WHITCOMB: No.

By Mr. Whitcomb:

Q. Well, have you ever decomposed lead oxalate and made patterns? Have you proceeded in that method?

A. I have decomposed lead oxalate, yes.

Q. And have you got the data for your patterns made from the results?

A. I think I have that.

Q. Are they in these notes?

A. If that is reports copied from those notes, yes.

Q. I have here a sheet with the spacings for the calculated theoretical results by Dr. Clark, using the a sub zero value of 5.33, and another one calculated from Ferrari, using the value of a sub zero of 5.38, and also a corresponding list of those found from Dr. Clark's charts submitted in evidence, and I would like to have you check these over and see if they are correct?

A. All right.

(Discussion off the record.)

The Court: Well, I think we might as well adjourn at this point.

Mr. Whitcomb: We would like to have this marked, for identification, as the Plaintiffs' Exhibit No. 62.

(Sheet showing the comparative numerical values calculated and found for a cuprite structure was then marked as Plaintiffs' Exhibit No. 62.)

(Recess, 12:30 to 2:00 P. M.)

AFTER RECESS.

Present:

Counsel as before noted.

WHEELER P. DAVEY, recalled.

Cross-examination (Continued).

MR. MORRIS: If Your Honor, please, I offer in evidence as Defendant's Exhibit 139 Dr. Davey's notebook number 1,—

THE COURT: All right.

MR. MORRIS: —as Exhibit 139, Dr. Davey's notebook 4, which is a continuation of notebook 1; as 140 Dr. Davey's notebook 2; and as 141 Dr. Davey's notebook 3, which is a continuation of 2.

(Notebook of Dr. W. P. Davey, number 1 was marked Defendant's Exhibit number 138.

Notebook of Dr. W. P. Davey, number 4 was marked Defendant's Exhibit number 139.

Notebook of Dr. W. P. Davey, number 2 was marked Defendant's Exhibit number 140.

Notebook of Dr. W. P. Davey, number 3 was marked Defendant's Exhibit number 141.)

By MR. WHITCOMB:

Q. Will you now proceed with this Exhibit 62 and state whether these figures given as Dr. Clark's are correct or not?

A. If Dr. Clark certifies that those figures are a correct copy I will accept it without further investigation.

MR. WHITCOMB: Well, you do, do you not, Dr. Clark, the theoretical—

DR. CLARK: Well, did you check those calculated values on the slide-rule?

THE WITNESS: I have just now seen them, they have been away from my vision all during noon hour, because they were in the Clerk's desk, but if you will tell me that these correspond, that the first column corresponds to the best set of composite data you can find for your centrifuge sample, that the second column corresponds to theoretical planes corresponding to a lattice parameter of 5.38; that the third column corresponds to interplanar spacings calculated theoretically from a lattice parameter of 5.33, if you tell me that I will accept it without further question,—

DR. CLARK: I think it is all right.

THE WITNESS: —in the interest of expediting the case.

By MR. WHITCOMB:

Q. Then, in view of Dr. Clark's remark, you accept these, as you state?

A. Correct.

Q. Well, now, will you please take line for line and on the extreme left-hand side put the percentage of error that the first figure, 3.08, has, using Dr. Clark's figure 3.077 as the standard of comparison?

A. You will realize, Mr. Whitcomb, that that will take a certain amount of time.

Q. Yes, I do, but I think it is very important.

MR. MORRIS: May I make this—

THE COURT: It is all right, it may be very

important, but I might as well go out while he is doing it.

MR. MORRIS: I wonder if he can do this,—

MR. WHITCOMB: Sure, I think we could adjourn for ten minutes.

MR. MORRIS: —unless he is going to follow through on some other matters with that, why not let Dr. Davey do that tonight?

THE COURT: Well,—

MR. MORRIS: If you are going to follow through with it on something else, why, my suggestion is out of order.

THE COURT: Yes. Would you rather have it done now?

MR. WHITCOMB: Well, I would.

THE COURT: All right, let him go ahead. It will take about ten minutes, then?

MR. WHITCOMB: How long will it take?

MR. MORRIS: It might take a half an hour.

THE WITNESS: Is it permitted, Your Honor, to mark those percentages on the exhibit that has already been entered?

THE COURT: Yes.

MR. WHITCOMB: I would like that.

THE WITNESS: I am requested to mark it on an exhibit that have already been entered, is that right?

THE COURT: Well, is it the exhibit that have already been entered?

MR. WHITCOMB: One we entered ourselves.

THE COURT: Did you calculate the percentages?

MR. WHITCOMB: We haven't yet.

THE COURT: Has anybody done it?

MR. WHITCOBM: He has accepted the figures as they are on there.

THE COURT: I understand that, but nobody has calculated the percentage of difference.

MR. WHITCOMB: Estimated some of them, that is all.

THE WITNESS: If you will indicate, Mr. Whitcomb, about the degree of precision you wish for this work I can probably expedite it somewhat by making more approximate calculations.

MR. WHITCOMB: Well,—

THE WITNESS: For instance, here is 3.08 and 3.10, which is a difference of two, two parts in three hundred.

MR. WHITCOMB: Omit the middle one and take Dr. Clark's.

THE WITNESS: All right.

MR. WHITCOMB: On the basis of a hundred.

THE WITNESS: Well, you see, 3.077 to be compared with 3.08 would have to be called 3.08, as being closer to 3.08 than it is to 3.07.

By MR. WHITCOMB:

Q. Then you would call that accurate?
A. I would have to call that accurate.

Q. Hundred per cent?

A. Hundred per cent, correct. You have asked me to put down here the per cent error, you want zero per cent, not hundred per cent, don't you?

Q. All right, please write out a column "percentage of error".

A. Between the first column and the third column?

Q. Will you write that down, to?

(The witness wrote on Plaintiffs' Exhibit 62.)

By Mr. Whitcomb:

Q. What have you written there?

A. Per cent different between first and third columns.

Q. Yes, for line one you find no—

A. Line one I find no significant difference.

Q. Line two?

A. Line two, 2.61 from 2.66½ is about four and a half parts in 250, let's call it two per cent. If you come to the nearest per cent you are satisfied, are you not?

Q. I am satisfied.

A. Two per cent.

Q. The next line—

A. 1.84—

The Court: Well, you let me know when you get that done.

The Witness: 1.84 to 1.88 is a difference of four in practically two hundred. We will call that two per cent.

Mr. Morris: Mr. Davey, just put your figures down when you get them, without any filling in in the testimony, if you want to.

The Witness: I didn't suppose I was giving

testimony, I thought I was checking with Dr. Clark.

(The witness entered the remaining percentages on Plaintiffs' Exhibit number 62.)

By Mr. Whitcomb:

Q. Dr. Davey, now, read the percentages of difference that you have listed in the extreme left-hand column of the sheet Exhibit 62.

A. I have listed the following under the title of per cent difference between first and third columns—

The Court: Now, wait, let me put that on mine.

The Witness: Per cent difference between first and third columns, these are calculated by mental arithmetic, to save time of the Court.

By The Court:

Q. All right, what are they? Start with 3.08, what is the difference there?

A. Zero per cent.

Q. Yes.

A. 2 per cent.

Q. 2 per cent?

A. 2 per cent; zero per cent.

Q. Now, wait a minute, 1.84 is 2, is that right?

A. 1.84 is 2.

Q. All right.

A. Zero; 2; 2; zero.

Q. 2; 2—wait a minute, there is a blank there?

A. Then the next one is a blank.

Q. Zero, 2, 2, zero; then the next is blank?

A. Then the next is a blank.

Q. Then what?

A. The next one I have labeled, because of 1.33, no significant difference. I meant by that that the calculated value is only given to two decimal places, and, therefore, there is no significant difference—

Q. All right.

A. —between that and the value found to four decimal places of 1.326.

Q. All right, next?

A. The next column is a blank, because there is no calculated value given.

Q. Yes.

A. The next one is zero.

Q. Yes.

A. And then 1.

Q. Yes.

A. 1, 1/2, 1/2, 1/3, blank, 1 1/2, and zero.

THE COURT: All right.

By MR. WHITCOMB:

Q. Then the maximum percentage of error you found was two per cent, is that right?

A. For these two columns, yes.

Q. And you have already checked the third column, labeled Dr. Clark's calculated values, with Plaintiffs' Exhibit P-46, and find them correct, did you not?

A. The third column? I have taken Dr. Clark's statement that they are correct and that he has checked them.

Q. You also checked them?

A. I checked the first column.

Q. Oh, I beg your pardon, the first column, I meant?

THE COURT: All right.

By Mr. Whitcomb:

Q. I understand you to say that in your slide-rule an inch would give twelve per cent, about twelve and one-half per cent error?

A. Correct.

Q. Then—

A. At the portion where I calculated the error.

Q. Yes, and at a corresponding portion, then, an error of two per cent would be a leeway of between one-eighth and a quarter of an inch,—

A. I assume so.

Q. —is that correct?

A. As nearly as I can do mental arithmetic at present.

Q. Well, you agree that is about correct, then. Do mixtures of mineral ore, and so forth, have known chemical identifications?

A. I am sorry, the street car was raising such a racket I didn't hear all of the words.

Mr. Whitcomb: Will you repeat it?

(The question was repeated by the Reporter, as follows:

"Q. Do mixtures of mineral ore, and so forth, have known chemical identifications?")

A. Not in all cases.

By Mr. Whitcomb:

Q. Do proteins have known chemical identifications?

A. I am not an organic chemist, and am not qualified to give expert testimony along that line. I have been told by organic chemists that they have some definite formulas.

Q. They have definite formulas as to how they are put together, chemically speaking?

A. I think so. As I said before, I am not an organic chemist.

Q. Well, I am informed by our experts that they are not.

A. That is all right with me.

Q. Do you disagree with them?

A. I said I am not an organic chemist, and especially not a biological chemist.

Q. Well, do scientists have X-ray patterns for proteins?

A. Some of them.

Q. Do you know who Astbury is?

A. Yes.

Q. Who is he?

A. Astbury is a pupil of Bragg's, who is in charge of contextile research at Manchester, England.

Q. Do you know whether he has done anything in connection with X-rays on proteins?

A. Yes.

Q. Well, is your testimony that if there is no chemical, known standard with which to compare his results that his work is worthless on that basis?

A. I don't follow your logic. I have testified that I don't know, and that I am not an organic chemist, and certainly not a biological chemist.

By The Court:

Q. No, but he is going back to what you said in the very beginning, that if you haven't got any standard fingerprint to compare your found pattern with, that it is of no value. Now, would you apply that also to—

Mr. Whitcomb: Proteins, for example.

By THE COURT:

Q. —proteins, or any other substance?

A. Well, I have been told that certain proteins have a definitely established formula. I am not acquainted with the facts.

Q. I understand.

A. Just hearsay.

Q. Mr. Whitcomb is asking you if you assume there is no formula, does your testimony apply the same to proteins as it does to inorganic substances?

A. Yes, if there is no known formula for the protein, then it is not an identification.

Q. That is all he wants to know.

A. Except with one qualification.

Q. All right.

A. That if the protein can be identified by some qualitative test, so that you can definitely say by that qualitative test that this protein in this bottle is identical with this other protein in this other bottle, then the X-ray diffraction pattern might be an identification of the material in the bottle, without saying what the material is in the bottle, other than the fact that it is in that bottle.

Q. Yes.

By MR. WHITCOMB:

Q. I understood you to make some reference to solid solutions, Dr. Davey.

A. Yes, sir.

Q. Now, what is a solid solution, in your opinion?

THE COURT: I think he did define that. Do you want him to do it over again?

By MR. WHITCOMB:

Q. Well, I want to know, is it a chemically reacted substance?

A: I have written a whole chapter in a book with the intent of showing that solid solutions must have some kind of a chemical tie-up between the solute and the solvent, that that chemical reaction is not to be regarded as a chemical reaction between the solute and all of the solvent, but merely the atoms or molecules of the solute individually with certain immediately surrounding atoms or molecules of the solvent.

For instance, let me illustrate, if we have a solid solution of aluminum in silver, I have assumed in that chapter that we have instead of just aluminum atoms peppered around into the silver in a mechanical mixture of atoms, I have assumed and tried to give reasons for that assumption, that we have the compounds Ag_3Al peppered around in the silver, and that the aluminum can travel by giving up its combination with one silver atoms, making a combination with the silver atom on the other side, and in that way it can travel along, you might say hand over hand from one portion to the other, always, at any one instant, being Ag_3Al, with the same aluminum atom, but not necessarily the same three silver atoms. It is as if it divorced some of its wives and married still other ones, and kept that on in the process of travelling from one region of the alloy to another.

Q. Didn't you definitely state on page 530 in your book as follows:

> "Of course this does not mean that the law of definite proportions can always be demonstrated, especially in the sense in which it is explained to students in elementary chemistry. It does mean that we must assume the forces acting between solvent and solute to be chemical in their nature and the energies involved to be truly chemical energies."

A. That is another way of saying exactly what I have just got done saying.

Q. Then it has a chemical identification?

A. It has a chemical existence, not in terms of the individual atoms of the solute and the whole body of the solvent, but rather it has an individual chemical existence with the atoms of the solute and the immediately surrounding atoms of the solvent. In that event of a chemical union between the atom of the solute and the immediately surrounding atoms of the solvent we have the true law of chemical proportions holding.

Q. Do you think, then,—

A. Of course, it would be nonsense to try to apply the law of chemical proportions in terms of the whole body of solvent, because there would be many atoms there entirely out of the sphere of chemical influence of the individual atoms of the solute.

Q. Yes, of course, I was not talking about the whole body, I was talking of any place where it occurred.

A. So what I have said is identical in intent with what you have read.

Q. Then is it your testimony that in these Exide samples there is a solid solution of lead and PbO?

A. It was my testimony that we had a mechanical mixture of a material identified as lead and of a material identified as red PbO. As far as I know, I have said nothing about solid solution in Exide samples.

Q. Well, is it your testimony that there is no solid solution in the Exide samples?

A. My testimony would be that if—if there is any solid solution it must be of extremely small amount.

Q. Oh, it might be of extremely small amount?

A. If you define extremely small amount as being a small enough amount, of course, you get it down below the limit of measurement, and then, of course, any answer is correct.

Q. And if that existed, then, it would be, according to your book and according to your testimony just now, the result of truly chemical energies and forces acting, is that correct?

A. Let me answer, first, yes, and then let me amplify that a little bit, for the purpose of expediting the case. I think what you are trying to head me into is to try to say there must have been some Pb_2O there. I am perfectly willing to admit that if you get some oxygen into the lead that you will have a compound between the oxygen and the lead, but we have three perfectly well-known oxides of lead, PbO, PbO_2, and Pb_3O_4. Now, why pick on this Pb_2O, which has not been proved to exist, when you have three perfectly good oxides, any one or all of which may be used to fulfill the conditions outlined by the theory of solid solution?

Q. Well, what about the very initial process that starts when oxygen meets lead? Do you agree or disagree with Dr. Clark's theory about taking the oxygen into the molecule or atom?

A. As I understand Dr. Clark's testimony as to the initial stages of oxygen coming on to the surface of lead, he has given a version of Langmuir's well-known theory of chemical absorption,—

Q. Well, do you agree with him?

A. —which requires chemical action. I would agree that oxygen on coming in contact with lead would give any one of a number of chemical compounds as long as the chemical compounds are chemically possible, that all of those chemical compounds would attempt to decompose, each one attempting to decompose at its own rate for the temperature at which the experiment was tried, the less stable compounds would decompose more rapidly than the more stable compounds, so that eventually the stable condition would be that of the stable compounds.

I suppose you could write down a pageful of chemical formulas which might by some stretch of the imagination be assumed to be the chemical formula for an absorption compound lasting possibly a millionth of a second. If that is the interpretation to be given to your question I must say that you can take a great many compounds if you wish.

Q. And some of those might be in the ratio—

A. If you wish your—

Q. —of less lead than oxygen—less oxygen than lead,—

A. Yes, on the basis—

Q. —with oxygen—

A. On the basis—

Q. —of not more than one?

A. —of their lasting, say, not more than a millionth of a second, but if you want to know what a compound could be there, in the ordinary sense of the term "compound", then only the compound which persists is entitled to recognition, only the compound which persists for a length of time long enough to find it there is entitled to be called a chemical compound in the sense in which the term is ordinarily applied, in other words, in the sense—

Q. Then do you—

A. —in which it is applied outside of absorption compounds.

Q. Well, then, do you exclude your discussion, what chemical reaction goes on in the solid solution, as applying to such a condition as you last mentioned?

A. The compounds which I have described in my chapter on solid solutions are compounds which have a definitely known existence,—

Q. Well, that is not the question.

A. —and are compounds which actually appear in the alloy when the temperature and concentration are correctly adjusted.

Q. But that was not the question.

A. I am sorry, I thought it was.

Q. The question was, assuming the conditions you mentioned, of this small item of time as to when there might be the formation of the lead and the oxide, which would be broadly a suboxide, that is, in that there was one part oxygen and less amount—or more amount of lead, then would your chemical theory as announced in your chapter on solid solutions apply?

A. The theory in my chapter on solid solutions applies to the interior of the solid. What you and Dr. Clark have been talking about apply on the surface of the solid.

Q. Not limited to the surface, any action that goes on.

A. The theory of absorption is necessarily limited to the immediate surface. Otherwise it is not absorption.

Q. Well, what follows absorption?

A. After—after absorption you can have the production of the final chemical stable compound on the surface, and the migration of one or the other of the ions of that compound into the interior, the rate of that migration depending upon what the materials are, and the temperature, and to some extent, also, upon their state of impurity.

Q. Well, now, what part of your book on this question, the fact of truly chemical action in solid solution, limits it to surface action? Is there any?

A. It is well understood among physical chemists and metallurgists that solid solutions are intended —that the term "solid solution" is intended to apply to the whole mass of the material, and not to surface effects. It is well understood among physical chemists that the catalytic effects on surfaces are taken up—

Q. But you did not exclude—

A. —under entirely different categories.

Q. But you did not exclude the surface action, did you?

A. I was not writing a legal textbook.

Q. Well, then, you did not exclude it, did you?

A. I was not writing a legal textbook, and I was using the term "solid solution" in its ordinary, accepted scientific and engineering sense.

Q. Is it your testimony that when chemical PbO is formed the transfer from lead jumps immediately from the latticework of the cube, face centered cube shown on Plaintiffs' Exhibit 29, to the tetragonal form shown at the right-hand side of Exhibit 29?

A. To the best of my knowledge I have not testified so, but I would be willing to.

Q. Well, do you?

THE COURT: Yes, he says so. I understand that you do so testify in answer to that question.

THE WITNESS: Barring a slight expansion of the lead lattice, due to solid solution of oxygen in it, there should be no intermediate diffraction pattern possible, and, therefore, you should jump from a face centered cubic type of structure, giving a face centered cubic type of diffraction pattern, to the red PbO structure, which is a tetragonal, tetragonal type of structure. I know of no evidence which gives an intermediary type of diffraction pattern.

By MR. WHITCOMB:

Q. Well, what would the solid solution show?

A. I have already said that the solid solution would make a slight change in the lattice parameter of the lead.

Q. And would not approach the picture of the tetragonal litharge on the extreme right-hand of Exhibit 29 by any means, is that right?

A. The change from a cubic structure to a tetragonal structure must be a definite change, not a gradual change. It is to be assumed that the lattice of the lead, which is a face centered cubic lattice, could be stretched until further stretching would produce an unstable configuration of atoms and the attractions between atoms would immediately make the lattice jump to the other lattice. That is a matter of ordinary experience, confirmed by a great many chemical changes, and the change from one type of lattice to the other type of lattice is regarded ordinarily as a criterion of such change, and without the change from one lattice to another lattice it is assumed that there is nothing but solid solution.

Q. When you say that the structure stretches, I believe—

A. Some solid solutions cause stretching, and some cause contraction.

Q. Well, in the illustration you made—

A. I used stretching as an illustration.

Q. Well now, when that stretching occurred would a distortion also occur?

A. It depends upon circumstances.

Q. It might occur?

A. I know that in the case of non-cubic materials distortion occurs. I have never noticed any considerable distortion in a cubic crystal due to solid solution in the cubic crystal.

Q. How about iron and carbon?

A. There has been considerable controversy about the diffraction pattern of the compound Fe_3C. It is a difficult compound to get in a sufficient state of purity to settle all of the points in the controversy, so it is

very hard to tell when distortion of the iron lattice ceases and when you begin to get the beginning of some other compound.

I saw an article just the other day pending to show that there is still a second compound between iron and carbon, which is not the pure iron, which is not the Fe_3C, but is some other compound.

Q. What about Martinsite?

A. I have considerable difficulty in finding out what the word "Martinsite" means. I thought at one time I knew, I thought that Martinsite was a dispersion of Fe_3C, was a dispersed phase of a dispersion of Fe_3C. In talking to professors in our metallurgy department I find that they use the word "martinsite" to represent whatever it is they happen to have when they have iron and carbon present with certain heat treatments, they try to describe it in terms of photomicrographs, but they seem to be very indefinite in their terminology. I tried to be very definite and ran into trouble with the —ran into trouble in expressing myself so that the metallurgist could understand me, because they were necessarily indefinite in their use of the word.

Q. What would be, what would a distortion of a crystalline substance be, if it occurred?

A. That is a question something like asking what would the injury of a person be in an accident if it occurred.

Q. Do you think—

A. I don't know what distortion you have in mind, or what substance you have in mind, or anything of the sort.

Q. Well, haven't you any idea that at any time any of these crystalline substances take on any distortion and X-ray patterns of distortions have been taken, or is your testimony to the effect that it has never been?

A. My testimony is not to the effect that it has never been. It is quite likely that there might be some distortions, especially in the case of non-cubic crystals. In the case of cubic crystals I am not sure, I assume that the distortion in the case of the cubic crystal would iron out; because of the symmetries of the cubic type of crystallization, so that in the long run the distortions would be equal along all three axes, and, therefore, we would only get a change in lattice parameter.

Q. Well, how does PbO absorb oxygen to give $PbO_{1.10}$, for example? What transpires there?

A. Are you asking me what transpires, or what I guess transpires?

Q. Your testimony as to what transpires.

A. I have never studied the action of oxygen on PbO, going up to $PbO_{.1.1}$, so that I cannot testify from personal experience, I would have to give you just a guess. I have asked you if that guess is what you want.

Q. What would that guess be? What is your best opinion? Of course, you are not talking about guessing—

A. Since PbO is a non-cubic crystal I would assume that there would be distortions producing a distorted crystal of less symmetry than the original PbO. I am basing that guess on what happens in the non-cubic crystal of zinc.

Q. Well, on the other hand, what would be the effect of a distorted form of crystalline substance on an X-ray pattern?

A. If a crystal were distorted so as to change its crystal symmetry the effect of the distortion would be to displace some lines much more than other lines. If the effect of the distortion is merely to produce a change in the average lattice parameter, than all of

the lines will be shifted so as to give a diffraction pattern corresponding to the original diffraction pattern, but with a slightly different lattice parameter.

(Discussion off the record.)

By Mr. Whitcomb:

Q. But in your book, page 534, you state?

"Irrespective of whether the lattice parameter is increased or decreased, the regions near the ions would be distorted and so would produce little or no x-ray diffraction pattern."

You don't mean to say it would not produce a diffraction pattern, though, do you?

A. If the distortion was local, so as to be only in a region, say, ten or twenty atoms across, the distorted pattern, distorted structure would be so small as to show no appreciable diffraction pattern.

Q. But if you had a very senstitive X-ray apparatus, compared with one that is less sensitive, you might be able to detect that, is that right?

A. That is something like saying that if I had a sensitive enough rule I could measure the distance from here to New York in terms of the wave length of light. If I have a sensitive enough rule I have a sensitive enough rule. That is the only interpretation to give your question.

Q. Well, do you think, from what you heard of Dr. Clark's discussion of the sensitiveness of the apparatus used by him in his X-ray patterns, that he might get some distorted substances whereas one like yours would not give these lines?

A. I have calculated for you some of the departures from the face centered cubic pattern of the diffraction patterns which you asked me to calculate. Those departures are of the order of two per cent,

and I have no difficulty in reading my diffraction patterns to an order of one per cent for each line, and Dr. Clark has an excellent apparatus, and he is very skilful, and he is able to produce data which from its own internal evidence shows that he can get to a quarter of a per cent, but with one per cent accuracy for each individual line, which I claim, I can certainly detect two per cent, I think.

Q. But some of these lines give practically no differentiation. Then in that case wouldn't his apparatus have been more accurate than yours?

A. You are confusing accuracy of the apparatus and accuracy of interpretation of the diffraction pattern. I have—I have admitted that Dr. Clark had a face centered cubic diffraction pattern.

Q. Well, I am not limiting to that, I am just asking if he is more liable to pick out a distorted pattern than your apparatus would?

A. He could pick out—

Q. Your testimony about the faintness of the line—

A. He could pick out a lattice which was a little more distorted than I could pick out, but the distortions in his lattice are still big enough so I can pick them out with my diffraction pattern, I suppose.

By the Court:

Q. Do you mean a little more or a little less distorted?

The Witness: Will you please read my answer, and I can put the proper correction in it?

(The answer was repeated by the Reporter, as follows:

"A. He could pick out a lattice which was a little more distorted than I could pick out.")

THE WITNESS: He can pick out a greater distortion than I can.

By THE COURT:

Q. Oh, is that what you mean?

A. Yes.

Q. Oh.

A. Not much greater, but a little greater; enough greater so that it is probably of academic interest.

By MR. WHITCOMB:

Q. Well, then, your last answer is to the effect in your opinion that there is X-ray apparatus more sensitive than the one you are using at your university, and might detect further information in respect to these patterns?

A. I have already expressed the greatest admiration for Dr. Clark's apparatus and for his skill, and I have admitted that he can make a—can make measurements with his apparatus which are enough more accurate than mine to be of academic interest.

Q. And the same would apply to his ability to pick out faint lines, as compared with what would show up with your apparatus?

A. Again, a difference only of academic interest.

Q. The same interest might have some interest in this case, might it not, some bearing on the issue?

A. Yes, I think it might. If Dr. Clark actually got the faint lines which he told Dr. Wilson about, and I assume he did, because he has showed evidence of still stronger lines in his centrifuge pattern, it might have some bearing on the case, but it does not prove that the faint lines corresponded to Pb_2O, if that is what you are driving at.

Q. Will you produce the samples that you used in your tests, and also the films?

A. I haven't had time to go over the films, I have them all right here, and the samples are on deposit with Professor Ullmann, in case they are asked for.

Mr. Whitcomb: Of course, we want the films in.

Mr. Morris: Oh, sure, I will put the films in.

The Witness: The films can go in immediately if you are willing to take them with the identifications on the film, or if you want them sorted out in some definite order it will take some time time to sort them out.

Mr. Morris: I want you to sort them out. I want to put them in, and I will get you to sort them out now or a little later.

The Witness: They are all in numerical order in these boxes.

Mr. Whitcomb: We reserve the right to further cross-examine if necessary.

Mr. Morris: Sure.

Mr. Whitcomb: Also to the notebooks. I thought we could cover that—

Mr. Morris: Sure.

Re-direct-examination.

By Mr. Morris:

Q. Dr. Davey, I call your attention to the note on the bottom of Plaintiffs' Exhibit 53, Plaintiffs' Exhibit 53, which is apparently page 8 of Dr. Clark's research log, and I ask you, I direct your attention to the parenthetical expression in the note at the bottom and ask you what you have to say with regard to that.

(Plaintiffs' Exhibit 53 was shown to the witness.)

A. The note reads as follows: Note: It looks as if the sample obtained in this research contains some lead suboxide (if Ferrari had lead suboxide) and some other substance. The 2.23 and 2.11 lines look as if they might be lead sulfate lines".

Q. Does or does that not harmonize with the testimony that you have given with respect to the necessity for identification?

A. It does.

Q. Dr. Davey, in the beginning of your cross-examination you said something to the effect that had you made a longer exposure on your chart one you might have gotten additional lines. Will you explain that answer, and what additional lines would you have gotten, and why?

A. The lines from a given crystal—

Q. I am now referring to Defendant's Exhibit 137,—

A. Yes.

Q. —chart one.

A. The lines to be obtained from a given crystal are very large in number under ordinary circumstances. The lines corresponding to the large interplanar spacings are the ones which are most intense, and which register most easily on the photographic film. The smaller and smaller the interplanar spacings get, clear up to an angle of diffraction of ninety degrees, the weaker and weaker the diffracted lines become, other things being equal. For a given exposure on the photographic film the lines for large interplanar spacings are, therefore, more prominent than the lines for small interplanar spacings?

Q. Well,—

A. If we increase the length of the exposure we can bring out some of those weak lines, which may be so faint on the film as to escape notice entirely, those weak lines corresponding to the short, to the small interplanar spacings.

I do not mean to imply for a minute that we have introduced additional lines in the space covered by the chart, but rather that we would have been able to have extended that chart further toward the right.

Q. Do you mean or do you not mean that you would repeat farther to the right lines of the same character of those which you have on your chart already?

A. Belonging to exactly the same theoretical face centered cubic diffraction pattern, or whatever diffraction pattern it is.

Q. Do you or do you not mean that you would find in your diffraction pattern for lead lines that were not representative of lead?

A. I do not mean that longer exposure would bring out lines not representative of lead. I do mean that longer exposure would bring out lines of a greater diffraction angle than are shown with smaller exposures, but lines which fit beautifully with the theoretical diffraction pattern of lead.

Q. Would you have found, do you mean to say that you would have found or that you would not have found lines similar to those unaccounted for lines on Dr. Clark's diffraction pattern for lead, which is Plaintiffs'' Exhibit 48.

(Plaintiffs' Exhibit 48 was shown to the witness.)

A. On Plaintiffs' Exhibit 48 the lines which are not accounted for by the checks would not have been brought out from pure lead by further exposure.

By Mr. Morris:

Q. Does your answer to my previous question about the time or length of exposure indicate that you may, or not, that you may have failed to get Dr. Clark's so-called Pb_2O lines by reason of the shortness of the exposure of your film?

A. No, I exposed my films up to the limit to which the photographic film was capable, and still have a readable diffraction pattern.

Q. So that the absence of the alleged Pb_2O lines on your film cannot be accounted for in your opinion in that wise?

A. Correct.

Mr. Morris: That is all.

Mr. Whitcomb: Counsel for plaintiff wants to offer in evidence the article by Le Blanc for identification as Plaintiffs' Exhibit number 63.

(Article by Le Blanc was marked Plaintiffs' Exhibit number 63 for identification.)

Harold V. Anderson, was called as an expert witness on behalf of defendant and having been first duly sworn, testified as follows:

Direct-examination.

By Mr. Morris:

I am an associate professor of chemistry at Lehigh University. I have been such since 1930; five years. In the year '28-'29 I attended the University of Illinois as a graduate student under the tutelage of

Dr. George L. Clark, the plaintiffs' witness in this case. In the fall of that year of '29, I returned to the Lehigh University and established a laboratory to carry on work in the field of X-ray diffraction, and also began a course of X-ray technology.

Q. Have you done any work in connection with the Defendant's product in this case?

Mr. Whitcomb: If your Honor please, we make the objection, we understood the fundamental point of patent practice to avoid burdensome expenses was to have one expert for one thing on each side. Under the old practice, under the old rules, they used to take expert after expert, and that was one of the things that was desired to be overcome. Now, of course, each side could go out and get another expert, and the other side goes out and gets a third, and so on, ad infinitum.

The Court: Yes, well, is there a rule directed to that? I don't know.

Mr. Whitcomb: Well, I think it is an unwritten rule, I don't think there is any definite rule, but it seems to me, I have had it invoked against me, and unless there is some reason for going on and on, we have been operating under the theory that that would be the rule. It should be, I think, because it is only a question of going out and hiring some more professors from some more colleges, and getting them in. Now, when you get down below Dr. Davey and Dr. Clark they are not so expensive.

Mr. Morris: In the first place, there isn't such a rule. In the second place, if there were it should not apply, after in the year A. D. 1935 an alleged new compound has been found, and if there is any

work that anybody has done specifically in search for that compound it should be revealed to the Court, to enable the Court to determine its existence or non-existence, and what has happened to us in this case? The only evidence of infringement, so far as I know, if there is any, is a couple or perhaps eight lines on a sheet of paper, to wit, a camera film which Dr. Clark tells us is a Pb_2O line. Are we going to let it pass at that, if that is any evidence of infringement, and I doubt it, but that is the evidence of infringement, alleged infringement with which we are here confronted, and I should think we would be able to refute that by as many witnesses as we can have to testify with respect to that, and I may serve notice on the learned counsel for Plaintiff now that I propose to call, with your Honor's permission, not only Dr. Anderson, but also Dr. Ewing, who has used the microscope and other tests.

MR. WHITCOMB: Well, I am limiting it to the X-ray; one expert for one purpose.

MR. MORRIS: Oh.

MR. WHITCOMB: That is the fundamental rule.

MR. MORRIS: We have tried not only once, but we have tried doubly, with a series of experiments which are indicated by the pile of documents in Dr. Anderson's hands, to see with all the skill and care of which he is possessed, if he can find any evidence of these alleged Pb_2O lines, and I do not hesitate to say at the moment that he has found no such suggestion. We propose, with your Honor's permission, to prove it.

THE COURT: All right. Of course, you will agree that there should be some limit.

Mr. Morriss Well, we have down with us a rule that no more than six witnesses shall be called to the same point, and that is a different apparatus, also, and if two people at different places, working independently, and with all seriousness and all endeavor, who present their work here, not in three or four loose sheets, but in bound volumes, showing page after page of effort to find it, and precisely what they found, then I think that is a very great corroborative and accumulative evidence.

Mr. Whitcomb: I should think if we were going to go on and on like this it might be that the Court should appoint somebody to get a really independent—

The Court: Well, the Court has appointed somebody, but he is not an X-ray man.

Mr. Whitcomb: Well, that is it. Of course we want to reserve the right to take five more experts on X-ray, now.

Mr. Morris: I suspected—

Mr. Whitcomb: I do not mean that actually.

Mr. Morris: I suspected that, if your Honor please,—

Mr. Whitcomb: If we are going to be confronted with three or four here, just the mere weight of numbers we have to consider.

Mr. Morris: I suspected—

Mr. Whitcomb: Although I guess Dr. Clark equals two or three of the average.

Mr. Morris: I suspected that because of the

thinness of the prima facie case, but the prima facie case is the Plaintiffs' opening case, and his rebuttal is rebuttal, and I shall insist on that in this case, that is, the Plaintiff may not split in a patent case any more than in any other his case. He may, of course, in a patent case, as well as in any other, produce rebuttal evidence, but he cannot bolster up his case—

MR. WHITCOMB: But he can rebut the Defendant's case—

MR. MORRIS: Sure, he can,—

MR. WHITCOMB: by X-rays.

MR. MORRIS: —if he can.

MR. WHITCOMB: By X-rays.

MR. MORRIS: Well, I have nothing more to say.

MR. WHITCOMB: I think it is serious.

THE COURT: Well, I will take it, and note the objection, but I do suggest that it be made briefer than Dr. Davey, if possible.

MR. MORRIS: I think I shall have only two questions to this witness.

THE COURT: All right. There is something to be considered in regard to the cumulative nature of the testimony.

MR. MORRIS: Will you read my question?

MR. WHITCOMB: Of course, we would like that reservation that we may need to prevent further X-ray experts.

THE COURT: Well, I will have to meet that

when it comes. You cannot make any reservation to something you are not entitled to, and if you are entitled to it you don't need a reservation.

MR. MORRIS: This is to refute?

THE COURT: If you want to call another expert we will have to meet that situation.

MR. MORRIS: Will you read the question, please, Mr. Rodebaugh?

(The question was repeated by the reporter, as follows:

"Q. Have you done any work in connection with the Defendant's product in this case?")

A. I have.

By MR. MORRIS:

Q. What, and what did you find?

A. I have examined all of the official samples of gray oxide which were submitted to me and signed by Dr. Wilson, and in the examination I have found nothing more than metallic lead and red tetragonal PbO.

Q. What instruments did you use and under what precautions did you make your tests?

A. The X-ray apparatus that I used was an X-ray tube equipped with a copper target, and the specimen —each specimen placed into a small capillary tube, in an atmosphere of nitrogen. At the end of each tube, sample tube, was inserted a cotton plug, and the tube sealed with sealing wax, and that specimen tube was mounted in what is known as an X-ray photo goniometer.

The well-known powder method of X-ray analyses was used, using a cylindrical camera, and the specimen was rotated during the time of the exposure.

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The registrations, of course, coming from the various crystal planes were registered on the photographic plate or film in this cylindrical camera. Then the films were developed and each one of these films were measured with the highest possible precision, and the various calculations undergone to arrive at the interplanar spacings that are characteristic of the material.

Q. Had there been any material in the samples tested by you of the nature or character of that represented by the lines in Dr. Clark's Exhibit 21, number 6, would or would not your investigation have disclosed it?

A. I feel certain that if it was there in any quantity at all above one per cent I should have been able to detect the most intense line of that diffraction pattern.

Q. Dr. Anderson, have you made any experiments recently with the X-ray, by the X-ray method, with respect to lead oxalate?

A. I have, I have conducted a number of experiments trying to duplicate the work of Ferrari, just as Dr. Clark has done. Each time that we attempted to duplicate the pattern we obtained the composite diffraction pattern of metallic lead and red tetragonal PbO. In other words, we checked the work, the original work of van Arkel, and we were careful in these—I might mention that these specimens were all prepared under the direction of Dr. Ullmann, who can tell us the exact manner in which they were prepared.

Q. And did you give me the result of your X-ray analysis of the sample containing lead oxalate?

A. In the case of the more recent experiments we have found a number of diffuse lines from a specimen of the decomposition of lead oxalate after a period of two hours, as I have been told, which conform to some

of those lines of the Ferrari type of pattern. We find that they emulate those of undecomposed lead oxalate.

Q. Dr. Clark testified that he subjected the lead oxalate to a decomposition process for a period of two hours. Have you any experience with such matters, and can you tell me whether or not it can be decomposed under a vacuum, under a pump, within two hours?

A. We tried the experiment of decomposing lead oxalate at a temperature of 310 degrees, and the diffraction pattern of that material gives us these foreign lines, and we can attribute them to, some of them to metallic lead, some to red PbO, and others to undecomposed lead oxalate, and possibly some lead carbonate.

The reason I say that is this, that in the process of decomposition the greatest care and precaution was exercised in preparing this material, and in order to determine the exact pressure of the reaction flask it was subjected to a space discharge, and as long as any gas was evolved there was a discharge, a visible discharge, and that visible discharge did not disappear until after a period of, as I understand it, eight hours, which would indicate that there was still some material which had not been decomposed.

Q. Have you the measurements for this test, last test, which you have referred to?

A. I have.

By THE COURT:

Q. You did not see any of Dr. Clark's tests made, did you?

A. I did not, sir.

Q. You have his report and his testimony. Can you tell me in just a few words why you think that I ought to accept your opinion rather than Dr. Clark's on this matter?

A. Well, as far as my experience goes in this field in the past two years, working with these oxides of lead; I have endeavored to carry on the work to the highest degree of precision possible, —

Q. Do you think you have—

A. —and have been able to—

Q. —had a higher degree of precision than Dr. Clark?

A. I feel that I have, sir, and I have been able to reproduce all of the spectograms that have been published in the literature of stable compounds, so that I know that the apparatus is properly calibrated.

Q. What do you think, without going into it in too much detail, what do you think is wrong with Dr. Clark's conclusions?

A. Well, my personal opinion is that I think he had some undecomposed lead oxalate in his oxalate decomposition product, for the simple reason that—

Q. Well, but he made a lot of analyses other than the lead oxalate direct.

A. Yes, I realize that.

Q. He used that, I understand, merely as a check. He found his Pb_2O lines in the mill oxide and in the Exide oxide.

A. Well, we have tried to determine those,—

Q. Well, I understand—

A. —detect those.

Q. —you didn't find them?

A. No.

Q. I understand you didn't find them?

A. No, we couldn't locate them.

Q. I am assuming that you are both testifying in good faith. I am asking you what you think is wrong with Dr. Clark's results. How did he come to find them, or how did he come to think that he finds them?

A. Well, I don't know that I could answer that

particularly, because there are so many things that may enter into this—

Q. Well, of course, if you prefer not—

A. —diffraction pattern.

Q. It is, of course, in line with my own objection to this kind of testimony, but if you prefer not to criticize his method or testimony that is perfectly all right.

A. No,—

Q. I just wondered if—

A. —I have no criticism as far as Dr. Clark's method of analysis is concerned. I think he does a wonderful job of it.

Q. He does a wonderful job, but he gets exactly the opposite result from what you get.

A. Well, I feel that we have a difference in material and—

Q. Do you both do wonderful jobs?

A. With the methods that are considered reliable to the detection of as much as four per cent of a material I should be able to get the diffraction pattern of that material just as well as Dr. Clark.

Q. Well, it looks to me—

A. I don't get it.

Q. —as if somebody did not do a wonderful job here, or you could not have arrived at exactly opposite results. I don't know who it was, but—

A. I have my films and all of my measurements are here, so that I am able to show everything I have done.

THE COURT: That is all right, I am not suggesting anything that I think about it at all. I just was wondering.

By MR. MORRIS:

Q. Are you of the opinion or not that whatever

may be represented by the lines, so-called Pb_2O, in Dr. Clark's film illustrated by his Exhibit 21, number 6—

MR. MORRIS: Will you read me that, please, Mr. Rodebaugh?

(The question was repeated by the reporter, as follows:

"Q. Are you of the opinion or not that whatever may be represented by the lines, so-called Pb_2O, in Dr. Clark's film illustrated by his Exhibit 21, number 6—")

By MR. MORRIS:

Q. —was present in any of the Exide samples tested by you?

A. I am of the opinion that they were not present.

By THE COURT:

Q. Do you think those lines were present in the samples tested by Dr. Clark?

A. I don't know.

THE COURT: All right.

By MR. MORRIS:

Q. Did you make like tests with regard to the Toronto product?

A. I did.

Q. Official samples?

A. Official samples. I made what we call comparison spectra.

Q. With what result?

A. With the fact that they coincide exactly with the mechanical mixture of lead and red PbO.

Q. Did the Toronto product have any of the so-called Pb_2O lines in it at all?

A. Not that I could detect.

Q. Do you remember how many tests you made of that?

A. I can't recall offhand, but I have examined all of the specimens that were submitted from the Toronto experiment in January, and the comparison spectra of each one of those samples coincide.

Q. And none of them show any of the so-called Pb_2O lines?

A. That is true.

Q. Dr. Anderson, did you send a sample or samples to Dr. Davey?

A. I did.

Q. He has testified that he had one sample which was designated by number and he was not given any information with regard to its source. Do you recall sending him such a sample?

A. Yes, sir, that was sample number 28, so labeled.

Q. And what was the source of that sample?

A. That sample was one which was submitted to me by Mr. Hall in person, Mr. C. A. Hall. He did not tell me at the time the sample was given to me where it came from?

MR. MORRIS: Will you read me the last answer?

(The answer was repeated by the Reporter, as follows:

"A. That sample was one which was submitted to me by Mr. Hall in person, Mr. C. A. Hall. He did not tell me at the time the sample was given to me where it came from.")

MR. WHITCOMB: Of course, we have to object to that, then, as not showing it is connected with the case.

THE COURT: Well, I suppose they will connect it up.

MR. MORRIS: What Mr. Whitcomb wants to know is whether I am going to call Mr. Hall. I am.

THE COURT: Sure.

MR. MORRIS: Objection withdrawn?

MR. WHITCOMB: Well, let it stand.

MR. MORRIS: All right.

By MR. MORRIS:

Q. Dr. Anderson, will you be good enough to tell me how the oxalate oxide lines which you have testified to a moment ago compare with or differ from Ferrari's spectrum—diffraction pattern?

A. I have the diffraction pattern of lead oxalate and—is it the decomposition product, did you say, Judge Morris?

Q. Yes, the ones you just testified about on a two-hour decomposition of oxalate oxide.

A. This was a lead oxalate decomposition product after two hours at 310 degrees plus or minus 2, under a vacuum, and I find in this spectrum several lines which conformed to undecomposed lead oxalate.

Q. Did you give the measurements for those lines or say how they compare or differ? You needn't do it specifically.

A. I have it here. The lines, the 2.60 line which I find on the undecomposed, or, rather, on the lead oxalate decomposition product corresponds to a line on—I would say within the limit of error—with that of the oxalate, and a 2.48 line on the lead oxalate decomposition with the 2.45 on the lead oxalate itself; a 2.34 on the lead oxalate and a 2.32 on the decomposition prod-

uct; a 2.13 on the lead oxalate and a 2.16 on the decomposition, and there are other lines in here which I could mention.

Q. Then what would you say generally with respect to how Ferrari's alleged Pb_2O lines can be accounted for on a theory other than a Pb_2O theory, if you can account for them otherwise?

A. My understanding is that Ferrari's' material was an impure substance, and when treated with an acid effervesced, which indicated the presence of a carbonate, and it is just possible that he had a lead carbonate in there to correspond to some of his lines.

Q. In some oxalate?

A. In his lead oxalate.

Q. So that in this test which you have made you have found or not some ground for accounting for some or all of Ferrari's lines?

A. We have accounted for most all of Ferrari's lines.

Q. On this test—

A. Yes.

Q. —that you have just referred to. Have you your work sheets and films there?

A. Here are the films.

Q. All of them?

(The witness produced the records.)

By Mr. Morris:

Q. These are what?

A. The first one, this is the lead oxalate decomposition product after two hours at 310.

Mr. Morris: Which I offer as Defendant's Exhibit 142, and the film as 142-A.

(Work sheet showing lead oxalate decomposi-

tion product after two hours at 310 degrees, produced by the witness Anderson, was marked Defendant's Exhibit number 142.

Film showing lead oxalate decomposition test was marked Defendant's Exhibit number 142-A.)

By Mr. Morris:

Q. Dr. Anderson, I notice that this film is not of the same length as those produced by Dr. Clark. Will you tell me why?

A. These are taken by the General Electric diffraction unit, which employs a larger radius.

Q. And is this film on the quadrant?

A. On the quadrant of the circumference, called a quadrant cassette.

Q. While your copper diffraction camera, where you get the copper method, your camera uses this in the circumference of a cylinder?

A. That is right.

Q. And that is a shorter film?

A. That is a shorter film.

Q. All right, you have some copper film, some molybdenum?

A. I have.

Q. And this quadrant is a molybdenum film, while the shorter films of those are copper target?

A. Yes.

Q. All right, now, will you give me that sheet you had a while ago and tell me what it is?

(The witness produced another work sheet.)

By Mr. Morris:

Q. Number one represents what?

A. Lead oxalate.

Q. Lead oxalate, and what does column number two represent?

A. Another reading.

Q. For the lead oxalate?

A. Yes.

Q. That is, for the same test or another test?

A. That is the reading of the same film, only read by another person.

Q. Columns one and two, then, on this sheet, which is Defendant's Exhibit 143, represent readings of the same film by two different people?

A. Right.

(Work sheet entitled "Transcription of oxalate films", produced by the witness Anderson, was marked Defendant's Exhibit number 143.)

By Mr. Morris:

Q. And the film from which those readings were made is the one annexed to it?

A. That is right.

Mr. Morris: Which I offer as 143-A.

(Film of lead oxalate test related to Defendant's Exhibit 143 was marked Defendant's Exhibit number 143-A.)

By Mr. Morris:

Q. Now, can we bunch the rest of your work sheets and films?

A. Yes.

(The witness produced other records.)

The Witness: Here is mechanical mixture of lead and PbO. These samples that I am submitting now are all gray oxide.

Mr. Morris: I find these cannot be bunched as one without confusion, and it will take two or three minutes to separate them, that is all.

By Mr. Morris:

Q. This sheet is X-ray analysis of PbO, of Pb and PbO?

A. Right.

Q. Of a mechanical mixture 67.51 per cent of PbO, and 32.49 per cent of Pb?

A. Yes, sir.

Q. And the film is a copper film, copper target film from which the readings were taken?

A. Exactly.

Mr. Morris: I offer it in evidence as Defendant's Exhibit 144, and 144-A, two sheets, but the film is "A".

(Two sheets entitled "X-ray analysis of Gray Oxide (Finished Product) 2d Official Sample" were marked Defendant's Exhibit number 144.

Film related to Defendant's number 144 was marked Defendant's Exhibit number 144-A.)

By Mr. Morris:

Q. These sheets which you now hand me together with the films represent X-ray analysis of gray oxide, finished product, with the films, with the measurements thereon of the films annexed thereto?

A. That is right.

Mr. Morris: Which I offer in evidence as Defendant's Exhibits 145 to 151, inclusive, with the films annexed to each of those exhibits being given the "A" marking for that number.

(Two sheets entitled "X-ray Analysis of Gray Oxide, Finished Product (1st Official Sample)" were marked Defendant's Exhibit number 145.

Film related to Defendant's Exhibit number

145 was marked Defendant's Exhibit number 145-A.

Two sheets entitled "X-ray Analysis of Gray Oxide—Under Screen (1st Official Sample)" were marked Defendant's Exhibit number 146.

Film related to Defendant's Exhibit number 145 was marked Defendant's Exhibit number 146-A.

Two sheets entitled "X-ray Analysis of Pb and PbO (Mechanical Mixture 67.51% 32.49%)" were marked Defendant's Exhibit number 147.

Film related to Defendant's Exhibit number 147 was marked Defendant's Exhibit number 147-A.

Two sheets entitled "Lead Ball taken from inside of Mill near discharge and (J. H. W.) X-ray Analysis of Powder from Surface of Lead Ball" were marked Defendant's Exhibit number 148.

Film related to Defendant's Exhibit number 148 was marked Defendant's Exhibit number 148-A.

Two sheets entitled "X-ray Analysis of Gray Oxide (Under Screen) 2d Official Sample" were marked Defendant's Exhibit number 149.

Film related to Defendant's Exhibit number 149 was marked Defendant's Exhibit number 149-A.

Two sheets entitled "X-ray Analysis of Gray Oxide (Screen Product over P_2O_5)" were marked Defendant's Exhibit number 150.

Film related to Defendant's Exhibit number 150 was marked Defendant's Exhibit number 150-A.

Two sheets entitled "X-day Analysis of Gray Oxide (Finished Product over P_2O_5)" were marked Defendant's Exhibit number 151.

Film related to Defendant's Exhibit number 151 was marked Defendant's Exhibit number 151-A.)

By Mr. Morris:

Q. Dr. Anderson, have there been people as disclosed by the literature who have attempted to follow Ferrari and have written with regard thereto?

A. There have.

Q. Do you happen to have the Ferrari publication and the publications of such other persons?

A. I have. I have made abstracts of each one of those.

Mr. Morris: I don't want the abstracts, unless the publications are too long. I may have in my files copies of those, and when they are collected, I will collect them during recess, if I have them, and offer them then.

The Court: Yes.

Mr. Morris: Otherwise, direct examination closed.

By the Court:

Q. Just let me ask one question, this lead suboxide, now, you are getting into the general state of the literature, this lead suboxide was first mentioned by Berzelius a hundred years ago?

A. In the chemical literature it was mentioned.

Q. And since that time do most ordinary textbooks, elementary books and that sort of thing, include it?

A. Yes, it has been included in practically every chemistry text in existence. It was not until 1925, when we had the X-ray method, that van Arkel, in working with other suboxides, such as nickel, partic-

ularly attempted to show that nickel suboxide was made up of metallic nickel and nickel oxide, NiO, and this led him to a study of lead suboxide and from the decomposition product of lead oxalate he made an X-ray spectogram and published his results, and then he came forth with the diffraction pattern, composite diffraction pattern of metallic lead and red PbO.

Q. Was that before or after Ferrari made his—

A. That was published before Ferrari's work was published, but Ferrari knew of van Arkel, van Arkel's results, while he was undergoing his experiments.

Q. And then—

A. And he published anyway, in spite of the fact that he knew there was a disagreement, and since then, of course, there have been many workers who, as Dr. Clark has said, have attempted to duplicate Ferrari's work, which he himself has never been able to reproduce, and the dozen or more times that we have attempted to reproduce it, each time we have failed, in spite of our careful technique.

By Mr. Morris:

Q. One thing that I want to make sure of, did you compare a moment ago your lead oxalate decomposition lines and measurements with Ferrari's lines and measurements?

A. Yes.

Q. Now, I am told that we did not. Won't you check?

A. You mean—will you state the question again, please?

Q. I thought a moment ago that I had asked you to compare your two-hour oxalate oxide lines with Ferrari's lines. I am told by my associates that we did not make comparison. I thought we did. Let's do it and make sure. I want the lead oxalate pattern, dif-

fraction pattern, and the lines on that compared by you with Ferrari's spectogram.

A. I think that was submitted as one of the exhibits.

Q. Will you come down and find it?

THE COURT: Well, that is all you want to ask him, is it?

MR. MORRIS: That is all.

THE COURT: Well, then, suppose we recess for ten minutes.

(Recess at 3:45 o'clock P. M.)

HAROLD V. ANDERSON, recalled.

Direct-examination (Continued).

By MR. MORRIS:

Q. Dr. Anderson, supplementing my last question, I hand you Defendant's Exhibit—

A. No, the next one.

Q. —143, and ask you to compare your lead oxalate measurements not only with Ferrari but with the Clark film and with the Shields film, which is one of the work sheets produced by Dr. Clark, and show how the oxalate lines coincide with the Clark additional lines and the Ferrari additional lines, if they do so coincide?

A. The first line on the lead oxalate coincides exactly with that of the first line of Clark's film, and is a 3.30 spacing in each case.

The next lines that corresponds is a 3.03 on the oxalate, which corresponds to a Ferrari 3.08.

The next line that corresponds with the oxalate is a 2.68 lead oxalate with a 2.64 Clark, 2.65 Ferrari, and a 2.66 Shields.

The next line that corresponds is a 1.88 lead oxalate, which corresponds with a Ferrari 1.87.

The next is a leadoxalate line 1.843, which corresponds with a Clark 1.84.

The next line is a 1.669 lead oxalate, which corresponds with a 1.66 on Shields.

The next line is a 1.61 lead oxalate, which corresponds to a 1.60 Ferrari.

The next one is a 1.57 lead oxalate, which corresponds to a Clark 1.58 and a Shields 1.59.

And, then, a line on the lead oxalate 1.241, which corresponds to a Clark 1.24 and a Shields 1.25.

Those are the major correspondences.

MR. MORRIS: I offer in evidence, if your Honor please, the article by Ferrari, which has been referred to numerous times, as Defendant's Exhibit 152.

(Said article was then marked as Defendant's Exhibit No. 152.)

MR. MORRIS: I offer in evidence, as Defendant's Exhibit 153, the article by Le Blanc and Eberius, entitled, "Investigations on the Existence of Lead Suboxide Pb_2O", which has been referred to.

(Said article was then marked as Defendant's Exhibit No. 153.)

MR. MORRIS: As Defendant's Exhibit 154, I offer in evidence the article by Friche and Ackerman, "On the Existence of Lead Suboxide Pb_2O".

(Said article was then marked as Defendant's Exhibit 154.)

MR. MORRIS: As 155, the van Arkel article, concerning the so-called suboxide of lead.

(Said article was then marked as Defendant's Exhibit No. 155.)

THE COURT: Let's see the van Arkel article.

(Discussion off the record.)

MR. MORRIS: As 156, the article by Darbyshire, entitled "An X-ray Examination of the Oxides of Lead":

(Said article was then marked as Defendant's Exhibit No. 156.)

(Discussion off the record.)

By MR. MORRIS:

Q. Dr. Anderson, I will ask you whether any of those persons, other than Ferrari, were able to find the so-called Pb_2O pattern?

A. They were not able to find the so-called Pb_2O.

Q. So you are not alone, Dr. Anderson, in being unable to find any of this product unless you turn to the oxalate in the Ferrari or the Clark lines?

A. No, I was not.

THE COURT: All right. Here's van Arkel.

MR. MORRIS: Cross-examine.

Cross-examination.

By MR. WHITCOMB:

Q. Dr. Anderson, I wanted to have one of the Plaintiff's films in possession at the same time, but take one of your films—Exhibit 144-A, that shows both sides?

A. Yes, sir.

Q. As compared with Dr. Clark's films, his films are only one-half the size of yours?

A. That's right.

Q. Dr. Clark's film is about five and a half inches and your half is what?

A. Probably in the neighborhood of three and a quarter inches. The radius is three centimeters.

Q. Then, in round numbers, by the same token, his would be about twice as accurate as yours?

A. Not necessarily so, I should say. I feel that those lines, as they are registered on the film, are extremely sharp and hair lines, so to speak, and are very easily measured with a viewing box and a pair of machinist's dividers.

Q. But, even so, they are not as easily measured, especially as to spacings, as Dr. Clark's lines with his six inch film. Is that right?

A. As I look at Dr. Clark's film, or rather his Exhibit 21, I think these lines are resolved just as well.

Q. But all the lines you have are about three inches, and those that he has are spread over about six inches of film?

A. That is right.

Q. You introduced some General Electric films, I believe?

A. Yes.

Q. But not with a copper target?

A. With a molybdenum target.

Q. And you worked with Dr. Clark. So, as you recall it, would you consider that he would rely on those General Electric films?

A. Well, the copper we have, it is as long as that of the molybdenum and will bring in the large spacings. It will bring in the large spacings much more readily than the shorter. We have the length, I am sure. I think the General Electric unit has its value in readily

obtaining interplanar spacings. I must admit the lines are not as sharp on the General Electric films as they are on the copper films when the specimen is rotated. As long as we have standard on the same film, in the case of the General Electric unit, it enables us to get very accurate measurements.

Q. But if you had the two—the film taken with the molybdenum and the one taken with the copper, as, Dr. Clark testified he had both—would you expect him to rely only, primarily, on the one taken with the copper tube? Is that right?

A. For spacing measurements, yes.

Q. What about the fogging in the background?

A. In the case of the copper rays, I don't think that there is such an enormous amount of fogging here that will show.

Q. But I am speaking of your General Electric.

A. With the General Electric, there is more fogging than there is with the copper.

Q. Not only more but it is decidedly noticeable, isn't it?

A. Yes.

Q. In your opinion, could lead oxalate be found in the mill oxides, the Exide oxide?

A. No.

Q. Then, how do you account for t lines which you say correspond to the lead oxide to the lead oxalate lines on the film that Dr. Clark had of the Exide oxide?

A. Well, there's just the possibility that since there is carbon dioxide in the atmosphere that lead carbonate may be formed, and lead carbonate which has a—which has been analyzed by, I believe, Zachariasen, Chicago, and the lattice constants are published by Wyckoff and other literature—that, if we take these things into consideration, you will find that there are

some of those spacings on lead carbonate that correspond very closely to those of the lead oxalate, but it is just possible that lead carbonate was present; not only it may be present in gray oxide, and it was undoubtedly present in Ferrari's.

Q. But you didn't make any tests for carbonate, did you?

A. The carbonate? I have not obtained pure lead carbonate or as a diffraction pattern of pure lead carbonate.

Q. Then, you don't know whether there is any carbonate line or lines in Dr. Clark's films or not, do you?

A. There is a method whereby you can evaluate these axial lengths and axial ratios by means of curves —that is, place the spacings on these curves—and actually determine the planes that are responsible for the reflections, and we will find—if we plot the spacing on a logarithmic scale and make our matches on the Davey chart, we will find—in the orthorombic system, I believe it is—that there is a correspondence.

Q. But you haven't done that?

A. I haven't done it personally, but I have seen Dr. Davey go through the same details.

Q. You were present when Dr. Davey listed the different variations from the theoretical on Plaintiff's Exhibit 62, were you not?

A. Yes.

Q. Do you remember the maximum variation found, theoretical to the actual, thus listed by—theoretical to actual values listed by Dr. Clark was two per cent. Is that correct?

A. Yes.

Q. Now, these checks that you have attempted to make of lead oxalate and read into the record this afternoon, they vary at least by two per cent, do they not?

A. I should say so. The lines are diffused. That is characteristic of an organic compound.

Q. Some of them vary much more than that, I believe?

A. It is just possible.

Q. The measurements for the undecomposed lines for oxalate correspond with those lines listed by Dr. Clark as suboxide lines?

A. May I see those spacings, please, sir?

Q. (Paper handed to witness.)

A. No, they do not.

Q. Then, to that extent, your testimony does not find the correspondence that you mentioned?

A. There were matches which would indicate that there are lines corresponding to lead oxalate.

Q. Well, it—so several compounds, like ten compounds of the patternss, show corresponding lines between miscellaneous ten compounds?

A. Yes, there are many instances of that; in fact, I can take the Ferrari spacings and match up a great many of them with orthorhombic yellow PbO. There are also some red PbO lines.

MR. MORRIS: Where?

THE WITNESS: In the Ferrari pattern.

MR. WHITCOMB: That is all.

Re-direct-examination.

By MR. MORRIS:

Q. Then you find in Ferrari's lines, if I understand your last two answers, lines which correspond with your red PbO lines and your orthorhombic or yellow PbO lines?

A. Mostly yellow PbO lines, and one or two red PbO.

Q. How many of his lines, of Ferrari's, can be accounted for by the PbO in its tetragonal and its orthorhombic crystal form?

A. I will give you that in just a minute.

Q. If you haven't that now—

A. I can find it; I have it right here. I have my other copy, and it won't take but a minute.

(Discussion off the record.)

THE WITNESS: I find the match in the theoretical yellow PbO of Ferrari's pattern of twelve lines, and four on the red PbO.

By MR. MORRIS:

Q. So that sixteen of Ferrari's lines can be accounted for not only by the oxalate but also by—my question is wrong and it is withdrawn. So that you can account for sixteen of the Ferrari lines by red PbO and yellow PbO. Is that right?

A. That is right. That is, those lines on the Ferrari pattern—

Q. Match?

A. —correspond to the theoretical spacings of yellow PbO. That's twelve lines on the yellow, and there are also four lines on the red PbO, spectrum.

Q. So that sixteen of Ferrari's can be accounted for by—

A. This.

Q. —this?

A. Yes.

Re-cross-examination.

By MR. WHITCOMB:

Q. Then you are now testifying he did not have the oxalate lines. Is that right?

A. I am testifying that there are lines corresponding to yellow PbO in the Ferrari pattern, and they may correspond to other lines in other materials.

Q. The very same lines?

A. That is a possibility. Yes, sir. We have many samples of that.

Q. Then, of course, that does not exclude Dr. Clark's direct-examination and testimony that it may be Pb_2O, does it, or suboxide?

A. Unfortunately, I have never seen any lead suboxide or obtained any diffraction pattern or lead suboxide, so I cannot answer your question.

Q. Then your answer is you don't know?

A. I don't know.

Mr. Morris: That's all, Dr. Anderson. Thank you.

(Discussion off the record.)

Mr. Morris: Dr. Davey is recalled.

Wheeler P. Davey, recalled.

Re-direct-examination.

By Mr. Morris:

Q. Dr. Davey, will you take the stand, please?

A. Yes.

Mr. Morris: I offer in evidence the films of Dr. Davey, made by Dr. Davey, of Electric Storage Battery Company gray oxide, the numbers of which are marked on this box. I offer the box and its contents as the Defendant's Exhibit 157.

(Box of films marked as Defendant's Exhibit No. 157.)

Mr. Morris: The second box, with like contents but different films, the numbers of which are marked on the box, I offer as 158.

(Box of films marked as Defendant's Exhibit 158.)

By Mr. Morris:

Q. What films are these in the box that I now hand you?

A. These are diffraction patterns taken in connection with the work at the Electric Storage Battery Company in order to obtain a knowledge for this hearing.

Q. They are just additional films of the same kind?

A. All four boxes contain films.

Mr. Morris: I offer this box and contents as 159, and I offer this box and its contents as 160.

(Two boxes of films marked Defendant's Exhibits Nos. 159 and 160, respectively.)

By Mr. Morris:

Q. Dr. Davey,—

A. Yes.

Q. —have you any book showing the diffraction pattern for lead carbonate?

A. I have.

Q. Will you produce them?

A. I have here a book, the second edition of Wyckoff's book, entitled "The Structure of Crystals", published by The Chemical Catalogue Company. On page 274 are listed the fundamental data for $PbCO_3$. It is listed as being orthorhombic in structure with three lattice parameters, 5.14 Angstroms, 6.10 Angstroms, and 8.45 Angstroms. The data are taken from an ar-

ticle by W. H. Zachariasen, published in a Norwegian book, called "Skrifter Norske Vindenskaps—Akad. Oslo I. Mat.—Naturv. Klasse", in 1928, No. 4.

Q. Do you find that any—

THE COURT: Let me see that book.

THE WITNESS: Yes. That's the one that is marked there.

Q. Have you another book in which you find the measurements of the diffraction patterns for lead carbonate?

A. No. I have a book containing a semi-log and charts, by which the match between the theoretical patterns may be obtained—between the theoretical patterns and the experimental patterns may be obtained.

Q. All right. Will you tell us what this discloses?

A. I have written on the margin of this sheet certain lines on a logarithmic scale going with the chart on page 612 of my book. Those lines correspond, as accurately as can be made with pencil, with the diffraction pattern for Professor Clark's highest accuracy lines for his so-called Pb_2O.

From Zachariasen's data I can deduce that if we use the lattice parameter 6.10 as our reference parameter, we get axial ratios of 8.4 is to 1 is to 1.4, which is approximately the same as shown on the chart on page 612 of my book.

The chart on page 612 differs only in that it is for axial ratios of A is to 1 is to 1.4 instead of 1.8. I think I am correct—yes, I am correct. If, on that chart, I try to superimpose the lines of Professor Clark's pattern of highest accuracy on the axial ratio of 8.4 on the chart, I find a very nice and interesting match.

Now, I should emphasize in this that we are in the position of a fingerprint expert who has a portion of a fingerprint with which to identify his so-called crim-

inal. If he has a portion of a fingerprint, of course, he can't expect to prove that he has identified a particular man, but he can say that it is this man or that man or this other man, because you can limit the identification to those men for whom the corresponding portion of the fingerprint matches the print which he has in his possession.

And so it is not surprising that with what we might call a portion of a diffraction pattern of something called by Dr. Clark Pb_2O we do not know what it is that we may be able to—it is the diffraction pattern—the diffraction pattern matches for that portion of a diffraction pattern with a great many other possible structures than the one which he has assigned within the same limits of precision that he has used in saying that his matches were the face-centered cubic type of pattern.

I have had a great deal of fun in going through some of these charts trying to find whatever it was, but this one for lead carbonate is especially interesting. I should like to start with the smallest interplaner spacing of Dr. Clark's measurements, and I can testify more directly in terms of the chart.

MR. WHITCMOB: Don't you think we ought to object on the ground that it is probative and has not weight because—

By MR. MORRIS:

Q. There is a correspondence of lines?

MR. WHITCOMB: —admittedly, only partially —being part of the lines?

(Discussion off the record.)

THE COURT: Is he going to testify a few of these lines that Dr. Clark found are matching lead carbonate?

MR. MORRIS: Yes, sir.

(Discussion off the record.)

THE COURT: Oh, I guess we might as well, but I don't know whether you are objecting or not. You asked me whether you ought to object.

MR. WHITCOMB: Yes, sir. I am objecting.

THE COURT: I suppose I ought to go over and look at it.

(Discussion off the record.)

THE WITNESS: Now, then, starting with the interplanary spacings which are the smallest, the 1.22 line comes at the place where several lines on the orthorhombic diffraction pattern have the same interplanary spacing. Therefore, there should be a great many planes contributing to the X-ray intensity at that particular diffracting angle, so we might expect an especially strong angle there. The next larger line of 1.25 comes at a place where—

By THE COURT:

Q. Is this the oxalate pattern down there?
A. Yes, sir. Clark's pattern.
Q. The oxalate is—

MR. MORRIS: The—it's carbonate.

THE COURT: I understand.

By THE COURT:

Q. But, what's the other thing?
A. The pattern is Clark's pattern listed as his highest accuracy lines for Pb_2O.

This 1.25 line also comes at the meeting place where several types of planes give the same type

of interplaner spacing and, therefore, might be expected to give a strong enough line to register, even in small quantities.

The 1.68 lines comes at the meeting place of about four lines and, therefore, might be strong enough to mention.

The 1.53 comes for a single line, and the 1.66 comes for a single line, of such a nature that it might be expected to be strong because of the particular layers of atoms it represents in the crystals.

Q. Does that mean—does that amount to your saying he had lead carbonate in that compound he analyzed?

A. It amounts to my saying this, your Honor: Two reputable scientists of the State of Pennsylvania do not find equal lines, and others in the State of Illinois finds the lines. Presumably, then, there is a difference between the two samples. I am not suggesting that that difference between the two samples might have been due to the presence of carbonate in Professor Clark's and the absence in Professor Anderson's and mine. It might be due to the absence of carbonate at the time we took our sample. Of course, that does not preclude the possibility of his, Professor Clark's, fundamental evidence from his decompositron of lead oxalate being lines composed of small amounts of undecomposed oxalate.

He has a partial fingerprint there which will match, so that he can have a basic set of Pb_2O lines from an oxolate experiment and another almost exactly corresponding to them from the oxide, the second one being from carbonate.

By Mr. Morris:

Q. The substance so far of your testimony, then,

in regard to this matter is what? That he may have had—

A. That in his oxalate experiments he may have had some undecomposed oxalate, and that in his oxide experiments he may have had some lead carbonate.

MR. MORRIS: Cross-examine.

Re-cross-examination.

By MR. WHITCOMB:

Q. Dr. Davey, how long have you been working on these lead composition patterns?

A. Since approximately last New Year's.

Q. Approximately—how many years?

A. Since approximately last New Year's.

Q. That is about nine months or ten months?

A. Yes.

THE COURT: Do you mind letting me see your book, too, Doctor—

THE WITNESS: Certainly.

THE COURT: —when you are through with it?

THE WITNESS: Yes.

(Discussion off the record.)

By MR. WHITCOMB:

Q. Do you understand that you can distinguish between the lead oxalate line and the lead carbonate line?

A. If I had a complete diffraction pattern of lead carbonate and a complete diffraction pattern of lead oxalate, starting from the lines of the largest interplaner spacing and going a reasonable distance toward the smaller interplaner spacings, we could certainly

distinguish between the two; but, when you have a portion of a diffraction pattern, it is possible to make that portion of a diffraction pattern fit portions of several other theoretical patterns.

Q. And the same reasoning would apply, if Dr. Clark is correct, in his finding suboxide of lead; that is, in lead oxide less than—

A. He has never offered in evidence any evidence except his statement that it was Pb_2O. So far as I am concerned, we might as well call it a "What-is-it" or a "What-have-you". I am trying to help out by suggesting what this "What-is-it" or "What-have-you" might have been.

Q. In your last testimony, you are dealing with these few lines?

A. I am dealing with all the lines Dr. Clark submitted to the Court to the level of the highest accuracy. I am giving him every break I can.

Q. As far as the patterns you are comparing is concerned, you are—they are all lines on that pattern?

A. They are lines which the theoretical pattern would lead you to believe would be strong lines, so that if he had only a small amount of carbonate in the oxide product and, therefore, had strong lines of the carbonate in his diffraction pattern, he would still have a good match for what is supposed to be the strong lines for the theoretical pattern.

Q. As I understand your testimony, you attribute some lines to the yellow PbO and the red PbO, is that right?

A. I didn't say so, but it is perfectly true that if you wanted to you could get a great many coincidences. You could get some coincidences with the red PbO.

Q. Do you disagree with Dr. Anderson's testimony?

A. Not, as I remember it. Dr. Anderson said there were certain coincidences, and there are.

Re-direct-examination.

By Mr. Morris:

Q. Mr. Davey, just a moment. Are you familiar with the standing and reputation of Le Blanc and Eberius in this field, or are you not?

A. They have a very good reputation.

Q. I am asking you that question with respect to the Defendant's Exhibit 153. Do you know the reputation and standing of Friche and Ackerman in this crystal field?

A. I don't believe that Friche and Ackerman are so well known, but as far as I know no fault has been found with their work.

Q. May I ask that same question with respect to van Arkel?

A. Van Arkel's work is very highly regarded by his fellow scientists.

Q. Darbyshire?

A. Same answer.

Mr. Morris: That is all.

Mr. Whitcomb: Just a minute.

The Court: Do you want to go right ahead?

Mr. Morris: Yes, sir, if that will suit your Honor. Maybe we can finish with the properties tonight, if it is convenient.

The Court: All right.

Mr. Whitcomb: That is all.

The Court: I want to just ask Dr. Davey one more question.

By The Court:

Q. Lead carbonate could be detected by an ordinary chemical analysis, couldn't it?

A. Yes, sir.

Q. Lead carbonate?

A. Oh, yes, provided you had enough of it there to come within a good quantitative analysis, you could.

Q. Dr. Clark testified, to subject it to a chemical analysis, you could not determine whether there was any lead carbonate there or not?

A. Provided you had enough of it there to make a microanalysis, you could.

Q. Micro-analysis?

A. Yes, micro-analysis, that's especially adapted for very small quantities of material.

Q. The point I am getting at is whether it would be possible to exclude your suggestion that these lines are lead carbonate by a chemical analysis of the sample?

A. I don't suppose he has enough of the sample he actually took the diffraction pattern of for a greater analysis. Of course, another sample from the mill, if it showed carbonate, would be fine, but—

Q. Well, how much does he have to have to show that?

A. He has testified that he finds about four per cent, I think, of this "What-is-it" in this Exide oxide. I assume, therefore, he would need something like twenty-five grams of material.

THE COURT: Well, he has that much left of the samples.

MR. WHITCOMB: Do you have that much left?

DR. CLARK: Yes.

MR. WHITCOMB: Yes.

THE WITNESS: Dr. Clark, himself being a

professional, chemical analyst, would be much more competent to tell you how much more material he would need to make a good analysis of the lead carbonate up to four per cent content.

THE COURT: All I wanted to know was if that suggestion you made—which I understand was not intended for more than a suggestion—that there might be lead carbonate in the mixture that would account for those lines could be either definitely proved or disproved by a chemical analysis.

THE WITNESS: I think it could, granted there was enough of the material.

By MR. MORRIS:

Q. Are you chemist enough to tell me whether the following might also be a sound hypothesis: Carbonate might have gotten in after the sample was opened and being tested in the laboratory of Dr. Clark?

A. It might.

THE COURT: It would still be there if it was in at the time—oh, you mean after he took it out of the tube?

MR. MORRIS: I don't mean and, of course, I want to disclaim any suggestion or inference from my suggestion that Dr. Clark put it in—

THE COURT: Sure.

MR. MORRIS: —but my opinion is that, on exposure to the air— and I intend to show that by Dr. Ullman—that the carbonate may form by the Co_2 in the air. Now, as a consequence, in answer to your Honor's inquiry, it might be found or it might not be found, but the carbonate might have gotten in it during the handling of it.

THE COURT: Now, Judge, is it yours and Dr. Davey's combined position that this suggestion of his is capable of proof or—capable of being proved or disproved?

THE WITNESS: No.

MR. MORRIS: No, sir.

THE COURT: I don't know which one to ask, but I am just wondering.

THE WITNESS: May I amplify my statement?

THE COURT: Yes.

THE WITNESS: That there is, evidently, a difference between Dr. Clark's material and my material. That difference may represent the presence of lead carbonate in Dr. Clark's material. We have no knowledge of the history of Dr. Clark's material. We don't know whether, by reason of accident, some of the sample—of the official sample—may have been taken which contained a little carbonate and another portion of the sample contained no carbonate, and one of us, by some strange quirk got the sample that was free from carbonate and his was not equally free from carbonate, or he had samples working in his laboratory and liberating an excess of carbon dioxide at the time he was preparing his specimens, and he might have made more carbonate in the laboratory than we did.

By THE COURT:

Q. Do you think your theory that you are now expounding is the best, really, to explain why Dr. Clark found what you didn't find?

A. It is a perfectly possible and plausible theory.

Q. Well, have you any better theory? We can, of course, assume, when you start out—otherwise, you must start with the proposition he didn't find the lines he said he did.

A. I didn't suggest that. Professor Clark is a reputable man.

Q. Well, if he found certain lines, there must be some explanation of it. Now, the suggestion you are making, now, is that the sample he analyzed is different from the one you analyzed?

A. That it contained an impurity which ours did not contain.

By Mr. Morris:

Q. I direct your attention to the centrifuge and the petroleum, or whatever it was, that was used in that machine, together with the use of that machine. Are you enough of a chemist to know whether there is a possibility there of getting some carbonates in your product?

A. I can answer your question in two ways. It is well known in the electrical industry that gases are quite soluble in oils. There may, therefore, have been considerable gas contained in the petroleum or either the super centrifuge. Another possibility is that with the process which Dr. Clark has described for getting the oil off his specimen afterwards, that he might have left a thin skin of oil on the particles which he has taken out. That thin skin would not necessarily have to be more than a molecule thick, but it would oxidize quite readily under certain conditions, and it might very easily give a source of carbonate.

The Court: All right.

By Mr. Morris:

Q. Is there any more assurance that it is Pb_2O than it is lead carbonate?

A. To me, it seems much less reasonable—assigning a new type of chemical compound, violating all the principles—than to say it is lead carbonate.

Q. If you say it is Pb_2O, it violates all the tables?

A. Yes.

Mr. Morris: All right.

Re-cross-examination.

By Mr. Whitcomb:

Q. But you do not—you do know Dr. Clark made several samples and patterns that were not used in the super centrifuge machine at all, do you?

The Court: Sure, I know that.

The Witness: Yes. But, if he used the super centrifuge machine, he got strong lines.

The Court: Oh, yes; No. 6 wasn't from a centrifuge.

Mr. Morris: Yes, but No. 6 is only one.

(Discussion off the record.)

Mr. Morris: The only measurements that we have or was able to get of the measurements—are the measurements of Dr. Davey and Dr. Anderson—and the only measurements we have of any samples in the world that Dr. Clark has ever made, they are, and he has told us he has given us all—was Nos. 6 and 10.

The Court: No. 6 wasn't the centrifuge.

(Discussion off the record.)

MR. MORRIS: As far as we know, there has been no measurement because we have all of Dr. Clark's measurements. He has had only two samples that he has measured, and one is No. 6 and one is No. 10, and that is out of all six or eight test tubes full.

(Discussion off the record.)

THE WITNESS: Your Honor, may I clarify the point you brought up?

THE COURT: Yes.

THE WITNESS: No. 6 contained a very small quantity or amount of this "What-is-it" as evidenced by the weakness of the lines as ascribed to the "What-is-it". The super centrifuge obtained lines of much greater intensity, and I am trying to help out Dr. Clark by saying it is quite conceivable that the oxidation of a residual film of oil might have produced this same lead carbonate.

THE COURT: All right.

MR. MORRIS: Now, Dr. Ewing, please.

WARREN W. EWING, was called as an expert witness on behalf of defendant and having been first duly sworn, testified as follows:

Direct-examination.

By MR. MORRIS:

My present position is Associate Professor of

Physical Chemistry at Lehigh University. I have occupied that position for fifteen years. The experience and training that qualified me for that position was as follows: Doctor of Philosophy degree at the University of Chicago; two summers of work at the New Jersey Zinc Company, in the study of absorption and particle size. And I have been serving as referee on articles for the Journal of the American Chemical Society for four or five years. By referee I mean that when an article is submitted to the editor of the Journal he sends it to some referee to give an opinion as to whether it is worthy of publication in the Journal or not. I serve as one of those referees. In collaboration with Dr. Ullmann I have done some work in connection with the case now before this Court. I have formed a conclusion as to whether Pb_2O does or does not exist. My personal opinion is that it does not exist.

Q. Now, then, will you state your reasons why you arrive at that conclusion?

A. Would it be permissible if I refer to some notes that I have?

THE COURT: Yes, you can do anything you want.

THE WITNESS: I think I could get this out of the way faster. I have listed some evidence which I think is worthy to bring to the attention of the Court. The first I have listed is a chemical evidence dealing with this matter of so-called suboxide.

If lead suboxide exists, the lead would have to have a valence of one in Pb_2O, and that is contrary to its position in the periodic system, which is one of the oldest and most reliable of the chemical laws which we have.

Q. Will you explain, for the record, briefly, what you mean by valence?

A. Valence is sometimes called the combining power of an element; that is, a substance having a positive one valence will combine with a substance, sodium, having a positive one, chloride, forming sodium-chloride.

Q. Will you proceed from there, Dr. Ewing?

A. Now, if we assume that lead has a valence of one in this compound, Ph_2O, and we treat the compound with acetic acid, and the acetate has a valence of one, we should get a lead mono acetate. Lead suboxide is reputed to dissolve in acetic acid but we get no lead mono acetate, and even Dr. Clark in his testimony doubted the existence of such a compound, although he said that references had been made to it in the literature. Personally, I have never seen any such references made. The usual method for writing this reaction in the literature is that one molecule of lead suboxide reacts with two molecules of acetic acid to give one molecule of lead acetate, one atom of lead and one molecule of water.

Q. I wonder if it would help, Dr. Ewing, if you would use a crayon on a sheet of paper?

A. I will be glad to.

(Witness writing symbols on paper exhibit.)

THE WITNESS: You will find that referred to in various articles on—

THE COURT: They all assume the existence of lead suboxide?

THE WITNESS: Yes. This is for reactions which do assume the existence of lead suboxide.

(Discussion off the record.)

THE WITNESS: That gives a balanced action, all right, so we can account for every atom over here by the same number of atoms over there, but we find that we have here two lead atoms which —of which are mono valent.

We find that down in this compound we have a lead compound which is tri valent; that is, it is hitched up to two of these valences, giving us lead acetate. We find here a free lead atom, which has no valence. In other words, this mono valent lead atom has changed to this di valent—that should be di valent—atom, and another one of these mono lead atoms has changed to a neutral lead atom. The valence of one has increased; the other decreased. We say that one of them has been oxidized and the other reduced. Acetic acid is neither an oxidizing nor a reducing agent, so that we would have to assume, in this compound, we have an internal oxidation, oxidation reduction, in the metallic element.

MR. MORRIS: I offer that in evidence as the Defendant's Exhibit 162.

(Paper marked Defendant's Exhibit No. 162.)

THE WITNESS: I have another reaction which I want to follow. Should I write that on there, or should I wait?

By MR. MORRIS:

Q. You may proceed, Dr. Ewing.

A. Dr. Clark gave us the equation for this reaction in which he dissolved the so-called lead oxide in acetic acid.

Q. Will you draw a line—

A. That's right.

Q. —underneath that, and then will you proceed?

A. (After doing so) His equation was that Pb_2O plus four acetic acid gives two lead acetates plus two water. He neglected to balance the equation, but undoubtedly he meant to put in an oxygen molecule here (indicating) because he said it took place in an oxidizing atmosphere.

Q. That is, you have added an 02 right ahead—right behind the flight of the arrow?

A. Yes. Dr. Clark didn't put that in, but he mentioned it.

Q. Do you want to close your parenthesis?

A. All right.

Q. Will you examine your last equation and see whether that 02 you have inserted in the arrow's flight should be 20?

A. This is Dr. Clark's equation. I wish he would tell you that.

DR. CLARK: 01.

(Discussion off the record.)

By MR. MORRIS:

Q. Will you proceed, please?

A. Acetic acid is neither an oxidizing nor a reducing agent, as I have said. Therefore, the reaction could only be explained by internal oxidation-reduction between the lead atoms, because no other such internal oxidation-reduction is known between the metal ic elements.

Now, that assume that in the acetic acid that oxygen is dissolved; that such a rection of that, if lead suboxide exists, would be possible; but the objection to the reaction, as I recall Dr. Clark's de-

scription of it is he said part of this material dissolved quickly and part of it dissolved very slowly.

Now, if that is a true representation of the reaction, I see no reason why the reaction should not go ahead rapidly because this reputed—Pb_2O is reputed to react very quickly with acetic acid; that it is a very reactive substance, especially in the water—although we have only H_2O represented, the acetic acid is a solution where we have a large quantity of excess water—probably ninety per cent. or maybe ninety-five. We usually use about fifty per cent. acetic acid in these experiments, but there is a large amount of water. That's when the acetic reaction—I mean, in the acetic reaction and the lead suboxide—and when the water reacts with the lead suboxide.

The only way I can account for the slow reaction is that you would have to go back to the first reaction, in which you get metallic lead, and that, of course, would react only very slowly with the acetic acid in the presence of oxygen; and, if we do that, we are in the same predicament that we were when we attempt to use the first reaction in explaining the disappearance of lead suboxide.

The other explanation I might offer there is he said there was a certain amount of impurities there, which dissolved, as I understood him, very slowly but eventually did dissolve. And lead suboxide should contain, theoretically, 96.3 per cent. lead. His compound analyzed 95.88 per cent. lead, which left room for only four-tenths of one per cent. impurity. That's four-tenths of one per cent., of one-tenth of a gram, and is four-ten-thousandths of a gram—four-tenths of a gram in impurity. Four-ten-thousandths of a gram impurity in a substance as dense as lead suboxide, in a certain volume of acetic acid, would be hardly perceptible. It is just about the limits of

weighing in the ordinary analytical balance, the limit there being about two-ten-thousandths.

Another line of evidence which I might suggest, which leads me to conclude that lead suboxide does not exist, is the density determinations. Under Dr. Ullmann's supervision, in our laboratories, density measurements have been carried out on the Exide oxide, and these density measurements have been compared with the density calculated for that same mixture of lead and lead oxide that is—that is, red lead oxide. These two values check, and that is the value of the analyzed—well, let me put it this way:

Suppose the gray oxide analyzes fifty per cent. lead, or half lead—by percentage, I mean molecular percentage—fifty per cent. lead and fifty per cent. lead oxide which has a certain density as measured. Then, looking in the literature, we know the density of lead and we know the density of lead oxide, and we calculate what the density of that mixture should be.

Well, in our laboratory, these two values checked, showing that there is not room—there is no room for more than an infinitesimal—not infinitesimal but small traces of any impurities in these two substances.

Q. What two substances?

A. Lead and red lead oxide.

By The Court:

Q. Can you take a sample and, by chemical analysis, tell that there is nothing there except lead and lead oxide?

A. I don't think of any direct chemical method, but my next point here was a method which verges on the chemical, and that's the next evidence which I want to present, and that's the amalgamation evidence.

Q. Maybe I am using chemical in a narrower sense than you would use it. Go ahead.

A. Well, amalgamation means the dissolving of lead in mercury, but usually we don't speak of them as a strict chemical action itself.

By Mr. Morris:

Q. What is your density?

A. That is purely physical.

Q. That is purely physical?

A. Yes, sir.

Q. That establishes what?

A. That establishes that the gray oxide must be made up of a mixture of red lead oxide and lead.

Q. Now, you are passing to another test, namely, the amalgamation evidence, which you said is relating to the chemical test?

A. Yes.

Q. Will you proceed with that?

A. Lead dissolves in mercury, if you can get good contact between the lead and the mercury, although Berzelius said he based his evidence that he had suboxide on the fact that it would not amalgamate with mercury, and, therefore no free lead was present.

And it took such a genius as Dr. Ullmann, of Lehigh University, to prove that Berzelius was wrong there. He has shown that when these gray oxides are treated with mercury in the correct manner—and I believe that Dr. Ullmann is going to be on the stand to give his experimental detail.

The Court: Well, now, don't repeat it. I do protest. Don't both of you talk about the same experiments. If Dr. Ullmann is going to talk about this, don't you do it. Let's save time.

The Witness: Well, I will make it brief, then,

by saying that I consider Dr. Ullmann's test a very strong test to show that there is no gray oxide in the suboxide, and I will have to make the same remark about another test which Dr. Ullmann is going to testify to, and that is concerning the heats of reaction. I consider that Dr. Ullmann's heat of reaction experiment is even a stronger test than the amalgamation.

By THE COURT:

Q. Did you collaborate with him in those experiments?

A. In the heat of reaction experiments, I have given him and his assistants advice because I have been working on heats of reactions for many years.

Q. The other one, you did not?

A. The other one, I did not, no.

Q. All right.

A. And I consider that his heat of reaction experiment shows conclusively—

MR. BETTS: Your Honor, may we have stricken out from the testimony about what Dr. Ullmann did when this witness did not collaborate with him?

THE COURT: Oh, yes, I think so. I don't see why—except I will let his opinion stand that that is a good test, but that is all.

MR. MORRIS: We are not offering by this witness the mercury test or the heat of reaction test, although I understand he did collaborate with Dr. Ullmann in the heat of reaction to some extent.

THE COURT: Yes.

MR. MORRIS: But the question is on what he bases his conclusion that Pb_2O does not exist.

Now, then, if I don't prove this fact by Dr. Ullmann, of course, it should go out.

THE COURT: I will let it stand, as far as it goes.

(Discussion off the record.)

By MR. MORRIS:

Q. Will you proceed, Dr. Ewing?

A. I consider, then, that the heat of reaction experiment offers conclusive evidence that the gray oxide—that is, the Exide oxide—does not contain—well, I don't like that word infinitesimal—an amount but approaching an infinitesimal amount of lead suboxide.

Infinitesimal, to my mind, means none at all. It approaches it, but we might say ten times an infinitesimal amount. In other words, ten times nothing at all. A very small amount is the word I want to use, I guess.

By THE COURT:

Q. That's the most that could be there?

A. Yes.

By MR. MORRIS:

Q. Of what?

A. Suboxide in the gray oxide. That's the most suboxide that could be present in the gray oxide.

Q. Do you mean by that that you recognize the existence of gray oxide or assume it?

A. No, assume. When I say gray oxide, I assumed it, because when I started, I said I did not believe in it.

Q. All right. Will you proceed?

A. Of course, then, there is an X-ray evidence, but I am not an X-ray expert.

THE COURT: Well, now, you can't answer that question then, and that was what I was interested in. If you get a substance and you put it through all your tests, including Dr. Ullmann's tests, and you are absolutely satisfied yourself—one hundred per cent.—so that it is strong enough to hang a man in your opinion—is it your opinion that there was nothing in that substance by lead and some oxide of lead. Then you put it through the X-ray test and it shows the lines that are not the lines of ordinary lead or lead oxide, it does not follow, necessarily, that those lines must be the lines of some oxide other than PbO? Of course, I asked Dr. Davey that question and he didn't want to answer it because he is not a chemist and you don't because you are not an X-ray expert,

THE WITNESS: I don't think it requires an X-ray expert to answer that question.

THE COURT: All right. Let's have it.

THE WITNESS: The answer to that question is that if the product has been analyzed to show that there is nothing else but lead and oxygen present, then your examination is right. The extra lines must mean something other than oxide of lead, but it tells you nothing about what other oxide of lead is present, as far as I can see it, unless all other oxides are known and identified.

THE COURT: Sure. That's all I expect.

THE WITNESS: You might just as well as-

sume that Pb_2O is Pb_{s10} as far as I am concerned.

THE COURT: Yes. Now, let's leave out the physical test. You can tell by a chemical test, as I understand it, that the composition contains nothing but lead and oxygen. Can you go that far? Can you tell that, with absolute certainty, by you chemical tests?

THE WITNESS: To require—to tell that, with absolute certainty, that would require an extremely accurate experiment work, such as involved in determining atomic values.

THE COURT: Do you think you could do it?

THE WITNESS: I could not.

THE COURT: Do you think it could be done?

THE WITNESS: Yes.

(Discussion off the record.)

By THE COURT:

Q. You could limit yourself to lead and oxygen, those two elements?

A. Yes.

Q. But you could not, by a chemical test, limit yourself to lead and oxygen—that's lead and oxide—limit yourself to lead and oxide, PbO?

A. In a commercial product, you very seldom have a product which is pure enough to justify an analysis of that type.

Q. Yes. Another thing you couldn't do chemically is to identify a particular suboxide of lead present?

A. No.

Q. You couldn't go any further than to satisfy yourself that the substance you have, or the mixture you have, is lead and oxygen, as I understand it? You could do that, at least?

A. To a fair degree of accuracy.

Q. But you couldn't chemically satisfy yourself, even to that extent, what particular oxide of lead it was that was present?

A. No, because we can't purify the material to find out its properties.

Q. All right.

A. Before you analyze it, you have to know its properties.

Q. Well, but you know the properties of PbO?

A. Yes.

Q. Well, that's what I mean. I say, I don't believe you understood me, quite.

A. I understood you. You asked if we could analyze of all the compounds of lead or all the oxides which are present?

Q. Yes, that's about what I wanted to know.

A. Yes.

Q. In other words, the answer is?

A. The answer is I could not.

Q. Yes. In other words, if I give you a mixture—I don't know how accurately this is put—but a mixture, one-quarter lead, one-quarter PbO, and one-quarter PbO_2, and the other quarter sesquioxide—or whatever it is—all you could tell me about that mixture is it was lead and oxygen?

A. Chemically, yes.

(Discussion off the record.)

MR. MORRIS: You may proceed, Dr. Ewing.

THE WITNESS: I wonder if I could qualify that answer?

THE COURT: Well, just wait a minute while we change stenographers.

By MR. MORRIS:

Q. You inquired whether you might qualify that answer. What qualification have you in mind?

A. This is a supposition, the qualification—suppose that your mixture contained two oxides and lead, and I happen to know a test for that oxide, and I happen to know a test for that oxide, and I happen to know a test for lead; why, then I could analyze it.

THE COURT: Well, but—

THE WITNESS: But I don't know my chemistry of lead well enough to know whether I could give you specific tests for any two oxides and pure lead.

THE COURT: Doesn't anybody know that?

MR. MORRIS: Perhaps Dr. Ullmann can answer that question.

THE WITNESS: He might, but unless you did know the test for the particular substances my first answer stands.

MR. WHITCOMB: Well, let me see, then, we ought to have of record whether this is a chemical expert or what expert is this?

THE WITNESS: Physical chemistry.

MR. WHITCOMB: Physical?

By MR. MORRIS:

Q. Now, will you turn to your microscopic evidence, if you are through with the other?

A. Yes, sir. My personal investigation—

THE COURT: I always seem to get hold of the wrong man to ask my questions. They are more fugitive than the substance we are after, I guess.

THE WITNESS: My personal work with these oxides has been mostly with the microscope.

THE COURT: Yes, well, all right.

THE WITNESS: And I wanted—

MR. WHITCOMB: Of course, you must remember he drew all that on the chart.

THE COURT: I know.

MR. WHITCOMB: He tells about all those; one minute they are, one minute they are not.

THE WITNESS: That is freshman chemistry. The Judge is asking for graduate chemistry.

THE COURT: No, I am asking for sub-freshman chemistry.

THE WITNESS: No, you are way up in the graduate work, because if this were an easy question there would be no trial.

THE COURT: Well, I don't know.

THE WITNESS: I was given various samples of these oxides and asked to determine what the —what kind of particles went into the making up of these oxides, and the first experiment which I carried out was to make photomicrographs, magnification 1800 times, of an Exide oxide, one of the official samples, and Toronto oxide, and oxalate oxide, and various others.

THE COURT: Now, were those photomicrographs, were those photomicrographs that you had?

MR. WHITCOMB: Yes.

THE COURT: All right.

MR. WHITCOMB: We put some in.

THE WITNESS: How many of these do you want discussed? I have Toronto oxide, Exide oxide—

By MR. MORRIS:

Q. Why not just discuss the Exide and the Toronto? Have you that exhibit with the—

MR. YAMAOKA: 24.

MR. MORRIS: Just a minute, I want to refer you, I want your photomicrograph.

All right, proceed, Doctor, we will come to that later.

MR. WHITCOMB: 27.

THE WITNESS: Do you want the Exide Oxide?

MR. MORRIS: Yes.

THE COURT: I wonder if we are really going to get started on this? Don't you think we better let this go until tomorrow morning?

MR. MORRIS: Just as you like. It won't take much longer to finish it. I am wrong, if Your Honor please, it will take him much longer than six o'clock to finish.

THE COURT: Well, maybe possibly during recess you may see some things you can cut down a little on.

MR. MORRIS: We won't, if Your Honor please, we have cut this down to the bone already, and we have cut and cut until we cannot—

THE COURT: All right.

MR. MORRIS: —cut any more. Is it Your Honor's pleasure to stop now?

THE COURT: Well, I don't want to cut right in the middle.

MR. MORRIS: No, this is a new reason, and this is the particular field in which Dr. Ewing has done much work, and it will take quite a little while on this particular reason, will it not, Dr. Ewing?

THE WITNESS: Oh, probably twenty minutes.

MR. WHITCOMB: Do you want to go to quarter of six?

THE COURT: All right, go ahead for a while yet.

MR MORRIS: All right.

By MR. MORRIS:

Q. I hand you a copy of Dr. Clark's Exhibit number 27. I think this is my copy and not the official exhibit, but you may use that in connection with your reply here if you so desire.

A. I find in this particular examination at 1800 magnification the substance seems to be composed of two types of particles.

By THE COURT:

Q. Big and little?

A. Large particles and small particles, the small particles ranging in size from a tenth to five-tenths of a micron, and the large particles of such variation in size that it is difficult to get a representative sample under the microscope.

I find these same conditions exist with the Toronto oxide and with the oxalate oxide, the Toronto oxide very evidently having a smaller average particle size, that is, there are very few of them up to five-tenths of a micron; the oxalate oxide having particles apparently slightly larger than the Toronto oxide, although that is doubtful.

By The Court:

Q. Well, now the point of this is that you did not find these semi-transparent—

A. Not in—

Q. — lumps that Dr. Clark found?

A. Not in this particular set of experiments, but later on I did find particles very similar to those, and perhaps it would be a good idea to bring that point up next.

By Mr. Morris:

Q. Now, when you have prints that you want me to put in evidence may I have them? I have a set of three here. Are they copies—

A. They are copies.

Q. —one of the other, and they are what, and they show what?

A. On the back, mill number 3, screen product.

Q. 1800 magnification?

A. Yes.

Mr. Morris: I offer one of these in evidence as Defendant's Exhibit 163.

(Photograph entitled "Mill #3, Screen Product, 1800 X, W. W. Ewing" was marked Defendant's Exhibit number 163.)

By Mr. Morris:

Q. What is this that I now have in my hand, Dr. Ewing?

A. Oxalate oxide, 1800 X, sample supplied by Dr. Ullmann.

Mr. Morris: I offer that in evidence as Defendant's Exhibit 164.

(Photograph entitled "Oxalate Oxide P. 338, 1800 X, W. W. Ewing" was marked Defendant's Exhibit number 164.)

By Mr. Morris:

Q. Then the next, what I now have, is what?

A. It was supplied to me as 1916 oxide, Toronto pipe sample.

Q. The pipe sample from Toronto. Where did you get it?

A. Dr. Ullmann supplied it to me.

Q. Dr. Ullmann, all right, I will bring that out from him.

A. I think I can, maybe I can give you—

Mr. Whitcomb: Do we understand that this was obtained in 1916?

Mr. Morris: No.

The Witness: No, the label on that was 1916 oxide, January 11, 1933, 12.24 P. M., Willard Storage Battery, Toronto, Canada, pipe sample, signed G. H. W.

Mr. Morris: Now, then, let's leave off, may I with your approval, Toronto pipe sample, and leave off the 1916 oxide?

The Witness: All right.

MR. MORRIS: That is Defendant's Exhibit 165.

(Photograph entitled "Toronto Pipe Sample, 1800 X, W. W. Ewing" was marked Defendant's Exhibit number 165.)

THE WITNESS: May I go ahead.

By MR. MORRIS:

Q. All right, have you got any more?

A. After receiving, or after seeing the Plaintiffs' Exhibit number 27 I went back to the laboratory and took a sample of mill number 3, run number 25, and so forth, and so forth, official sample, took a small amount of that and placed it on the microscope slide, and placed some Nujol containing a five-tenths per cent. lecithin, which is a good dispersing agent, to get the material all separated, placed it under a microscope, and by moving the field back and forth here made some fifteen hundred field examinations, and in doing that I ran across several crystals which to me seemed to be very similar to the ones described by Dr. Clark, of which I made line drawings, which were also examined in our laboratory by Mr. Serfass.

By THE COURT:

Q. Which was that, the Exide oxide?

A. That is the Exide oxide.

Q. Yes.

A. And I have drawn line drawings of these crystals which show up. I examined these crystals under polarized light. I found some of them were isotropic and some of them anisotropic. When I compared them with the known sample of red lead oxide they seemed to be exactly similar in color and general appearance, and the explanation that some of them are

anisotropic and some isotropic could be that the tetragonal structure is such that when it is mounted on one plane it is anistropic, on another plane it is isotropic.

I have the various line drawings of these crystals.

Still thinking that it might be the suboxide, I thought it would be advisable to place them in water instead of Nujol, so I dispersed them in water on the slide and made exactly similar study, and found approximately the same number of these crystals. I find, I averaged up for several hundred runs and I found I was getting about one crystal to every twenty-five fields that I examined, so that I estimated their quantity must be less than one-tenth per cent. and probably less than that, even, and I found in the water similar crystals, some isotropic and some anisotropic, similar in appearance to the red lead oxide.

By Mr. Morris:

Q. Well, now, what deduction do you make from the fact that you found the same or similar crystals unchanged when you treated them with water, as to those crystals being Pb_2O?

A. I drew the conclusion that they could not be the assumed Pb_2O if it has the properties which have been assumed for it, namely, that it reacts very quickly with water.

Q. You did or did not find—you answered that; you may proceed.

A. Another study which I made was to take the oxide without dispersing it. I neglected to mention, perhaps, that in these 1800 magnifications the particles had been dispersed by a special process which is in use among particle size experts. It is not worth while, I believe, to—it is the Haslam and Hall process.

Q. Do you have any pictures, photographs, there of what you just testified to about these crystals?

A. Only in my line drawings in my notebook.

Q. Very well. Those crystals were similar, as I understand, in appearance to those illustrated or shown in Plaintiffs' Exhibit 27?

A. Yes, sir. That similarity in appearance does not identify them, however, as the same crystals, but I merely want to make the point that those were the only crystals—

Q. Just a moment,—

A. — I could locate of anywheres near the same nature in some two thousand examinations.

Q. You referred to water a moment ago, to which you subjected these crystals shown in Plaintiffs' Exhibit 27. Any air present?

A. Oh, yes, ordinary distilled water always has air in it.

Q. Yes, but done in the open air in the room, or not?

A. Yes, the water was allowed to evaporate off, leaving the dry powder nicely—well, not too nicely dispersed, but nicely enough dispersed so that it could be examined.

Q. Did any change—

A. No cover glass; out in the open air.

Q. And what change took place, if any?

A. None.

Q. All right, proceed.

A. The next examination which I made was to see just what the nature of the gray oxide is, as far as the microscope would tell, that is, without dispersing it, and so I placed this material on a cover glass by a special technique, I cemented it on with de Khotinski's cement, so that the slides could be

moved about without it dropping off, that is, the de Khotinski's cement did not touch anything but the bottom of the particles, leaving the rest of the particle free, as though no cement were there, and I have samples of some nine different oxides treated in this manner, and I have attempted to color these to show more clearly exactly what they look like.

This color is not very good, I am not an artist, it should be, as near as I can tell, that color (indicating). I colored only a few of them. They all should be colored.

Q. Now, these are photographs of what, Dr. Ewing?

A. Well, this is Toronto oxide. It is too green. It has a greenish appearance in general, but my—

Q. What magnification?

A. 60.

Q. 60 magnification?

A. Yes.

Q. Let's take off "1916 oxide" and call it Toronto.

A. All right. 1916 is what was on the label that was given to me.

MR. MORRIS: All right. I offer this in evidence as Defendant's Exhibit 166.

(Photograph produced by the witness Ewing, entitled "#1, 1/11/35, Willard Storage Battery, Toronto, Canada, J. H. W. 60 X, W. W. Ewing" was marked Defendant's Exhibit number 166.)

THE WITNESS: I have here a—

By MR. MORRIS:

Q. Will you pardon me just a moment?

A. Sure.

Q. Will you tell me what the Exhibit 166 purports to show, a Toronto oxide, but—

A. A Toronto oxide in which we have a large number of particles which have a greenish cast, and under the microscope in addition to that greenish cast you can also see bare particles of lead protruding here and there.

Q. Protruding through the green?

A. Through the green.

Q. All right.

A. That is, you can see metallic spots here and there all through it.

Q. What else did you do, Dr. Ewing, and why?

A. I treated these samples under the microscope—

Q. Which samples, the Toronto, or the gray oxide?

A. All of them.

Q. All right.

A. All of these oxides which I have presented photographs of I treated under the microscope with acetic acid, and as we watched, as I watched through the microscope I could see the acetic acid dissolve off the outer coating of yellow oxide, leaving chunks of lead.

Q. Referring now to the gray oxide which is represented in the photographs which I now have in my hand?

A. Yes, sir, and referring to those others, also. These are all gray oxides.

Q. Well, now, we don't need to put in any more than just one set of these, do we? Do we? What is the merit of the added ones, in particular?

A. These are collector's samples, this is bag collector's sample, Cyclone collector sample, mill one, run 20, and mill three.

Q. All right.

A. Some of them under the screen, some finished product.

Q. Let's lay these aside for the moment, or let me have them and let me number them tonight, so as not to delay now. Will you proceed?

A. If anyone cares to examine those I have here scales of the same magnification, which can be applied directly to these particles, and each division there is a hundredths of a millimeter.

Q. This measure you have given to Mr. Whitcomb, haven't you a copy of it?

A. Well, I have two copies, one of them probably should be on—do you want to make an exhibit of that, or not? It probably might be useful if anyone wanted to—

MR. MORRIS: I will offer the scale as Defendant's Exhibit number 167.

(Photograph entitled "Magnification, 60 X, W. W. Ewing" was marked Defendant's Exhibit number 167.)

By MR. MORRIS:

Q. Can you go on without my marking these photographs which I have in my hand?

A. Yes. I left off where I said I dissolved the yellow material off with acetic acid, leaving the chunks of lead. To confirm that those were chunks of lead I then placed silver nitrate on them, under the slide, and one could see the trees of silver growing, the typical reaction between lead and silver nitrate, to give silver and lead nitrate, with the lead gradually disappearing, and in its place a nice tree or bush of silver crystal. Scraped over with a needle point the lead had all disappeared, nothing but silver remained.

In order to find out something more about the nature of that lead which was under the oxide I dispersed the material in dry toluene, dried over sodium, containing four-tenths per cent. of lecithin, dried over P_2O_5, ran the mix through a colloid mill several times, and then separated the yellow fraction from the lead fraction, by decantation, and repeated the washing and decantation until eventually I had the lead fraction remaining, which did not seem to respond to any further treatment with toluene.

The sample which was obtained analyzed about, in one case, eighty-five per cent. lead, in another case, seventy-five per cent lead. When we looked at it under the microscope practically no lead oxide could be seen running around there, but looking down into some of these larger crystals we could see that there were crevices which contained the yellow oxide.

I have here pictures of—this one I believe perhaps is not admissible because that is a commercial sample, but these two are official samples, or that one, two copies of it.

Q. Showing what?

A. The lead after it had been run through the colloid mill and the decantation process carried out. I then ran that.

MR. MORRIS: I offer this in evidence as Defendant's Exhibit 168.

(Photograph entitled "Mill #1, Run 20, Coarse lead fraction separated from oxide mixture in toluene containing 0.4% lecithin in colloid mill, W. W. Ewing" was marked Defendant's Exhibit 168.)

By MR. MORRIS:

Q. Did you say this is eighty-five per cent. lead?

A. That particular one is seventy-five.

Q. Do you know what the rest was, the major part of it, at least?

A. Lead oxide. I think probably this should go in that same exhibit. The difference between these two slides was this, that in this one—

Q. Which you have in your hand?

A. Yes, sir.

MR. MORRIS: Which I offer as Defendant's Exhibit 169.

(Photograph entitled "Mill #1, Run #20. Fine lead fraction separated from oxide mixture in toluene containing 0.4% lexithin in colloid mill; W. W. Ewing" was marked Defendant's Exhibit number 169.)

A. (Continued)—I took the lead fraction and dusted it on to a slide, then tipped it over and knocked off what would knock off by tapping the back of it, and the last exhibit was the powder which still clung to the slide. That I termed a fine fraction. The heavy part which I could knock off went on to the other slide, and I have termed that a coarse fraction.

Now, if the Court wishes I can demonstrate in a minute or two the actual appearance of these materials under 60 magnification.

THE COURT: Well, we can wait a minute or two.

(The witness then demonstrated microscopic inspection of the slides.)

MR. MORRIS: You may proceed.

THE WITNESS: That finishes my microscopic testimony.

MR. MORRIS: That finishes your microscopic tests. From that you want to take up the equilibrium?

THE WITNESS: No, there was another microscopic test.

THE COURT: Well, it is six o'clock, I think we better conclude the entertainment, at this point.

MR. MORRIS: Well, I am still expecting and hoping to get through.

THE COURT: Tomorrow?

MR. MORRIS: Oh, yes, sir.

THE COURT: Well, all right.

ELEVENTH DAY.

Adjourned until Wednesday, October 9, 1935, at ten o'clock A. M.

DEFENDANT'S EVIDENCE (Continued).

MR. MORRIS: I offer in evidence, if Your Honor pleases, photographs referred to yesterday by Dr. Ewing, as Defendant's Exhibits 170 to 177, inclusive.

(Photograph entitled "Mill #3. Run #25, 6/21/34. Finished Product, J. H. W. 60 X, W. W. Ewing" was marked Defendant's Exhibit number 170.

Photograph entitled "Mill #3. Run #25. 6/2/34. Under Screen. J. H. W. 60 X, W. W. Ewing" was marked Defendant's Exhibit number 171.

Photograph entitled "Mill #3. Run #31. 8/3/34. Screen Product. J. H. W. 60 X, W. W. Ewing" was marked Defendant's Exhibit number 172.

Photograph entitled "Mill #1. Run #21. 5/25/34. Finished Product. J. H. W., 60 X, W. W. Ewing" was marked Defendant's Exhibit number 173.

Photograph entitled "Mill #1. Run #20. 5/16/34. Under Screen. J. H. W. 60 X, W. W. Ewing" was marked Defendant's Exhibit number 174.

Photograph entitled "Mill #1. Run #20. 5/16/34. Finished Product. J. H. W. 60 X, W. W. Ewing" was marked Defendant's Exhibit number 175.

Photograph entitled "Cyclone Collector Sample. 12:15, 4/17/35. J. H. W. 60 X, W. W. Ewing" was marked Defendant's Exhibit number 176.

Photograph entitled "Bag Collector Sample. 12:15, 4/17/35. J. H. W. 60 X, W. W. Ewing" was marked Defendant's Exhibit number 177.)

MR. MORRIS: I find that I overlooked yesterday in the mass of the exhibits the X-ray analysis of decomposition product of lead oxalate and the film which Dr. Anderson testified to, and I offer it as Defendant's Exhibit 178, and the film as 178-A.

(Two sheets entitled "X-ray Analysis of

Decomposition Product of Lead Oxalate" and sheet entitled "Interplanar Spacings of Decomposition Product of Lead Oxide" were marked Defendant's Exhibit number 178.

Film related to Defendant's Exhibit number 178 was marked Defendant's Exhibit number 178-A.)

WARREN W. EWING, recalled.

Direct-examination (Continued).

By MR. MORRIS:

Q. Dr. Ewing, you were testifying at the adjournment of court yesterday with respect to reasons which have led you to the conclusion that there is no Pb_2O. Have you taken in consideration in arriving at that conclusion the harmony and equilibrium testified to by Dr. Clark?

A. Yes, sir.

Q. What have you to say with respect thereto?

(Discussion off the record.)

By MR. MORRIS:

Q. Will you proceed, Dr. Ewing?

A. Dr. Clark in discussing harmony stated that there were eight different reactions which were proceeding in the mill, and that those reactions—

Q. Just a little louder, will you, please?

A. There are eight different reactions proceeding in the mill.

By THE COURT:

Q. Are those what he referred to as rates?

A. Yes.

Q. Eight different rates?

A. Eight different rates of reaction, or eight different rates proceeding in the mill.

The first of these, the rate of absorption, is a well-known rate that is agreed to, I believe, by all. That is, undoubtedly gases are absorbed on any solid surface to form a film.

His second rate was, the rate of the blast controls the thickness of the absorbed film. I don't know that I understand just what he means there by the thickness of the absorbed film, but if he is speaking in the ordinary terms used by the catalytic chemist I think we would have to disagree with him, that it is the rate of the blast which controls the thickness of the absorbed film. In absorption the gas goes on a surface according to the usual understanding in a mono-molecular film, and this mono-molecular film is formed very rapidly, probably a millionth of a second, in pressures of gas which are extremely small, down to limits which are barely measureable, and after that mono-molecular film is formed on the substance it may be that the film then begins to build up to a thicker film. If so, that undoubtedly is not conditioned upon the rate at which the gas passes over the solid, but is conditioned upon the pressure of the gas in the system, and that variation in pressure must be relatively very great. That is, the mono-molecular film is formed in the very rarefied gas, nowheres near atmospheric pressure, hundred thousands of an atmospheric pressure, and after you begin to build up pressure from that very rarefied condition you may possibly have a slight thickening of that film, but only with large relative increases in pressure.

Now, if Dr. Clark meant to say that the differ-

ence between the atmospheric pressure and the pressure existing in the mill, which I understand is a difference between fifteen pounds and seventeen and a half pounds, that relative change in pressure there should have practically no effect. If you change from fifteen pounds up to a hundred pounds it might be admitted that you had a very slight increase in the thickness of the film, but a small change in pressure from fifteen to seventeen would be insignificant.

As far as the rate of blast is concerned it could only be effective if there was a deficiency of gas present, and undoubtedly at atmospheric pressure, or at seventeen pounds pressure there is not a deficiency of gas, there is a very, very, very large excess.

By THE COURT:

Q. Well, I ask because it was not my understanding, and I am glad to get it now if it is correct, but was that Dr. Clark's view, that the rate of the blast affected the absorbed film?

A. That was my understanding of his words.

THE COURT: Was that what you intended to convey? If so, all right, and if not—

DR. CLARK: Well, the point there, Your Honor, is simply this, that experiments with catalysts indicate an optimum yield, that is, with certain rates—

THE COURT: Well, I didn't want to go into that with you,—

DR. CLARK: Yes.

THE COURT: —but all I wanted to do was to have you say either "yes" or "no", that Dr. Ewing has understood your view with regard

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to the increase, or the rate of the absorbed film. Has he understood it in what he has just said, or do you think he has misunderstood it?

DR. CLARK: Well, I think he is pretty close to the idea which I was trying to present.

THE COURT: All right, well, that is all I want to know.

THE WITNESS: That is on page 250 of the record.

THE COURT: I didn't catch that from your testimony, but I have it now. All right.

THE WITNESS: That is on page 250 of the record.

THE COURT: I knew that he spoke of the rate of increase of absorbed film, but I didn't know that he testified that the regulation of the blast had anything to do with it, but if he did, it is all right. All right.

THE WITNESS: The third rate was the rate of cooling by the air blast. I believe there is no discussion about that. That is a well-known fact. His fourth rate, the rate of chemical reaction of absorbed oxygen on lead to form lead suboxide; of course, that is a rate in which he has hypothecated an unknown substance, and the rate could be just as well explained by postulating a known substance, lead oxide, so that if in place of lead suboxide in that rate of chemical reaction of absorbed oxygen on lead we would substitute lead oxide, in place of lead suboxide, we could explain just as well how the reaction takes place. His fifth rate, the rate of diffusion of oxygen through the protecting outer layer of the lead

oxide is undoubtedly present, but my understanding is that the claim for this substance is a very porous substance, so that that rate would be very small.

His sixth rate, the rate of removal by abrasion, of course, needs no comment. That is acceptable.

The seventh rate, the rate of dissociation of lead suboxide, here again, of course, he has hypothecated the existence of an unknown compound, and assumed that—assumed certain properties for this compound. One is that the rate of—the property which he has here assumed is that this lead suboxide must dissociate to give atomic lead and oxygen—no, atomic lead and lead oxide, red lead oxide. Of course, this is just merely a hypothesis of what the property of an unknown compound would be. If we shou d grant that this compound exists we would have to grant then that when it did break up according to this reaction we would have atomic lead present, and my understanding of one of the reasons for hypothecating this unknown substance is to show that we do have very fine lead in the product. Of course, if this supposed compound did break up to give atomic lead, this atomic lead would be present in an atmosphere of air, at a high temperature, I believe around one hundred and sixty to two hundred degrees centigrade, and it is a well-known fact, that even very small crystals of lead, not atomic lead, but small crystals of lead, containing many atoms, when tossed into the air at ordinary temperatures ignite spontaneously with the air to form oxides. If that is a well-known fact, therefore, it must follow that atomic lead in the presence of air at a high tem-

perature would ignite much more rapidly than small crystals of lead in air at room temperature. Consequently, this atomic lead which is formed must of necessity be entirely removed immediately to form lead oxide, and cannot remain in the product.

By Mr. Morris:

Q. You say the atomic lead which is formed?

A. Yes.

Q. You mean that atomic lead is formed as a fact, or are you dealing—

A. I am dealing—

Q. — with a hypothesis?

A. I believe I made the remark that if we admitted that this substance were present that it must necessarily follow that atomic lead could not remain as metallic lead, but must be converted immediately into an oxide.

Q. I see, and you are still dealing with that hypothesis?

A. Yes.

Q. Very well, will you proceed?

A. I have some further confirmation of the fact that we cannot have extremely smal—or that it is not necessary to postulate Pb_2O in order to account for extremely small lead particles in our product, or in the Exide product. Dr. Wilson in his report quoted Thomas' book on Colloid Chemistry, that it is well admitted that materials cannot be made in colloidal dimensions by ordinary grinding processes, and I believe that remark has also been made in this trial at some point. Svedberg, who is one of the most famous colloid chemists in the world, has written a book on Colloid Chemistry, in which I would like to read a paragraph. He says:

"Von Weimarn,"—another one of the very famous colloid chemists—"the Russian colloid chemist, suggested preparing dispersion systems by a special grinding method. His suggestion was to mix the substance to be dispersed with some neutral solid substance which would dissolve as a molecular solution in the dispersion medium and grind them together. He did not make any tests, but in my laboratory, Pihlblad used his method with rather good success. If we take sulphur and grind it with urea, 1 gram of sulfur + 1 gram urea, then take 1 gram of the mixture and mix it with 1 gram of pure urea, etc., making up a series of mixtures, and then dissolve a portion of those ground substances, we get a series of sulfur sols"—in other words, sulphur colloids—"with increased degree of dispersion. The sols were examined under the ultramicroscope and the change of light absorption with change in degree of dispersion was studied. Pihlblad also used this method to prepare colloid solutions of a dye stuff aniline blue and got a series of varying degree of dispersion. Quite recently v. Weimarn and his co-workers have used the procedure to prepare sols of various material taking sugar as the neutral diluting agent.";

showing that colloids can be made by grinding if you have special conditions, that is, the material to be ground and a neutral crystalline substance.

Q. Have you any such substance in defendant's mill?

A. Yes, sir.

Q. What?

A. You have lead and the neautral crystalline substance, lead oxide.

Furthermore, wondering if lead could not be made into colloidal dimensions, I picked as my neutral substance paper, and as my substance to be made into colloidal dimensions, lead. I carefully rubbed the lead substance with very fine emery paper, to remove any film of oxide on the surface, and then rubbed the lead over a large sheet of paper many times to remove any emery that might be on it, or any loosened surface, and then made a very light mark on a piece of the paper used in making copies in typewriting, so lightly that you could hardly detect that there was any mark present.

I then fastened that paper on a microscopic slide with balsam, using the usual technique, covered it over with balsam and a cover glass, placed it under a microscope, and I have here photographs of the results.

Q. And what do those photographs show?

A. Magnified one thousand times, magnification 1000 X.

Mr. Morris: I offer it in evidence as Defendant's Exhibit 179.

(Photograph entitled "Photograph of a lead mark on paper, magnified 1000 X, W. W. Ewing, E. J. Serfass" was marked Defendant's Exhibit number 179.)

The Witness: The very fine points on there that look like very small blurs, if you examine it, you will find little pin points on there that just look like little blurs, in the general technique of particle size study at magnifications of this amount these small blurs are recognized as materials of colloidal dimensions, and the reason they are merely blurs rather than sharply de-

fined particles is that the particle is below the resolving power of the microscope. The resolving power of the microscope depends upon the wave length of light, and these are down so far below the wave length of light that they cannot be resolved by the microscope, no matter how much you magnify them.

The particles on there, those small particles, undoubtedly are no longer lead, but they undoubtedly were lead when the mark was made on the paper. That, however, would not change the size of the particle—the change from lead to lead oxide would not change the size of the particle; would not make it smaller at any rate.

Dr. Clark's final rate was the rate of oxidation of lead suboxide to lead oxide, and here I believe it is not necessary to say anything about this except that he has again postulated an unknown substance, for which there is—which it is not necessary to postulate in order to show that lead oxide is formed.

By The Court:

Q. Well, now, will you sum up your conclusions that you are drawing from this discussion of his eighth reactions?

A. To sum up my conclusions, I believe that it is not necessary to assume any lead suboxide to explain the harmony occurring in the mill, or to explain the fine rate—the fine state of subdivision of the lead, but that—but another harmony could just as well be built up without having to make assumptions which go against the recognized rules of chemistry.

By Mr. Morris:

Q. Have you anything further to add there, Dr. Ewing, in support of your conclusion that—

The Court: Well, now, just a line with that, as I understand it, though, Dr. Clark is not basing his testimony on a hypothesis, he is only using this matter that you have talked about, his reactions, to confirm an actual, physical fact which he says he has seen and touched. Now, am I right about that or wrong? Isn't that the point?

Mr. Whitcomb: Absolutely.

The Court: It is confirmatory of a physical fact which he testified to, namely, that he actually found lead suboxide in the samples. If I am wrong about that I have misunderstood everything that has been said since the case began.

Mr. Whitcomb: You are not wrong about that. That is exactly the point.

Mr. Morris: If Your Honor please, let us assume that you are right, that Dr. Clark and the plaintiffs' main contention, ultimate contention, is, "I have it, here it is".

The Court: Yes.

Mr. Morris: All right, but that is not where they begin nor, even if that is where they end, that is one of the factors which we have met and are still going further to meet. They might have brought in anything and labelled it Pb_2O. Indeed, Dr. Clark when he last went on the stand said, "I don't intend to confine myself, as did Shimadzu, to Pb_2O, I will take 2, 1 point, with a string of zeros",—

THE COURT: I remember.

MR. MORRIS: — and says that anything is suboxide.

THE COURT: Well, lead suboxide, let's substitute the word, lead suboxide.

MR. MORRIS: Yes, up to the ratio of one to one.

THE COURT: Yes.

MR. MORRIS: But this testimony of Dr. Ewing is addressed to those other things that were testified to by Dr. Clark. He is not the X-ray man, he is not the chemist, he is a physical chemist, and he is dealing with these things which Dr. Clark used to support his conclusion—

THE COURT: Surely.

MR. MORRIS: — that this substance that he brought in was Pb_2O.

THE COURT: Yes, I agree, I understand that, that is exactly what I had in mind, only the witness calls it a hypothesis all the way through, and it seems to me that where a witness, where a scientist has actually seen and felt the evidences of the presence of a substance it is not exactly a hypothesis.

MR. MORRIS: I wonder if it is not.

THE COURT: Well,—

MR. MORRIS: He christened it, he christened this substance suboxide without any justification whatsoever, so far as this evidence shows and will show when we are concluded.

THE COURT: Yes, I understand.

MR. MORRIS: Now, maybe that statement is a little too strong. There were lines which he found.

THE COURT: Yes.

MR. MORRIS: Every one of those lines except three have been accounted for by the presence, by Dr. Anderson, by the presence of PbO in its tetragonal and orthorhombic forms. Now, then, was the substance that he had Pb_2O? What were the other three lines? I don't know, but all of his lines have been accounted for by the yellow PbO and the tetragonal form of lead. Now, then, he could go through the whole realm—

THE COURT: Well, I know, we may not be far apart, but it seems to me, to use a perfectly crude illustration, when a scientist in a criminal case examines the inwards of the deceased and finds a substance there, and he says, "In my opinion this is arsenic, because it shows certain reactions. I have certain reasons to say so". That is not a hypothesis, that is his definite opinion, and those are the reasons for his opinion. I would not call it a hypothesis. Now, he finds an unidentified substance there that a layman cannot identify. Now, he is asked what it is. He gives his reason for it. First, he finds the presence of something there that does not belong in the normal diet.

MR. MORRIS: Yes.

THE COURT: Then he proceeds to say what it is, and he supports that by certain reasons. Now, I wouldn't say that was a hypothesis. That was

the only thought; it may be it is just a matter of words.

MR. MORRIS: I think so. I don't want to add anything except this, of course, and it is really not worth adding, but in dealing with arsenic we have a known substance and there is nothing to postulate.

THE COURT: We only know it by its reactions. Nobody can look at what it is.

MR. MORRIS: That is true, but we have it isolated prior to that.

THE COURT: Oh, yes.

MR. MORRIS: Arsenic.

THE COURT: Surely.

MR. MORRIS: So to the extent that this has been christened suboxide without its ever having been isolated, and even yet tested chemically, is what I suspect Dr. Ewing means.

THE COURT: Well, I agree that it may be merely a matter of terminology.

THE WITNESS: I could carry your illustration just a little further.

THE COURT: All right.

THE WITNESS: Suppose the criminal died of poison and the doctor had examined the remains and found a poison there,—

THE COURT: Now, wait, do you mean the criminal died of poison?

THE WITNESS: Well, poison was found in the remains, anyhow.

THE COURT: Of the deceased.

THE WITNESS: Yes.

THE COURT: You don't read enough detective stories, I am afraid.

THE WITNESS: And it is an entirely unknown poison.

THE COURT: All right.

THE WITNESS: It has never been heard of before.

THE COURT: Well?

THE WITNESS: The doctor says it is arsenic suboxide. Does that prove that it is arsenic suboxide, if arsenic suboxide has never been known to exist, and you cannot prepare it pure, or find its properties. He has hypothecated arsenic suboxide to explain something that covers up his ignorance.

THE COURT: Well, that might be so, but here is a substance that you say has never been known to exist that textbooks for a hundred years have all carried as a chemical substance. In 1925 a series of experiments undoubtedly threw a lot of doubt upon it, but I don't know that you can start out with the proposition it has never been known to exist.

THE WITNESS: Well,—

THE COURT: Maybe you can.

THE WITNESS: — perhaps I should not have said never has been known to exist, but if we trace these experiments that have been done on lead suboxide, trace down through the history, we

will find we have a very peculiar situation. First one man finds certain properties for it. When more accurate—well, I shouldn't say more accurate, I can see a pitfall there ahead of me, but when other experimenters carry out the same experiments in every case it has been found, excluding the present X-ray case, that the ones who had found suboxide had made a mistake somewhere along the line, and that later it was shown where that mistake was, how they happened to fall into the mistake.

THE COURT: Well, all I want to be sure of is that you are dealing, so that we won't have confusion, all I want to be sure of is that you are dealing with Dr. Clark's real testimony, with what he really intended to convey.

THE WITNESS: I think I am.

THE COURT: I don't believe the discussion is worth the time we are putting on it, because it may be just a matter of words, anyhow.

(Discussion off the record.)

By MR. MORRIS:

Q. Dr. Ewing, just one question, and that is of the relative fineness, will you please describe the relative fineness between the Toronto product and the Exide or defendant's gray oxide product?

A. The two photomicrographs which I submitted on these two samples show that the oxide in the Toronto product is a little finer than the oxide in the Exide product, but there is not very much difference; practically the same. The lead particles in the Toronto product are a little finer than the

lead particles in the Exide product, but here again, not much different.

Q. You are speaking of Dr. Wilson's samples taken from the Toronto mill operated on January 11, 1935, I assume, are you, Dr. Ewing?

A. The oxide was submitted—was taken January 11, 1935. The Exide was taken August 3rd, 1934, mill number 3.

Q. Both of them Dr. Wilson's samples?

A. Yes, sir.

MR. MORRIS: That is all. You may cross-examine.

Cross-examination.

By MR. WHITCOMB:

Q. Dr. Ewing, referring to Plaintiffs' Exhibit 27, showing these large crystals, I understand that you found on examination a rate, in your notebook, or drew some pictures in your notebook which in your opinion do correspond to what Dr. Clark found, excepting you make a difference in the distinction as to what they are. Is that right? In other words, you did find—

(Plaintiff's Exhibit number 27 was shown to the witness.)

A. I found large crystals similar to those which are shown in those photographs, yes— similar in appearance, I should say.

By MR. WHITCOMB:

Q. Now, I am informed that the index of refraction of those materials is 2.55 plus or minus — 2.553, plus or minus .002. What is your index of refraction for the material you found?

A. I did not determine it.

Q. Well, you did not determine the index of refraction?

A. No, sir.

Q. Well, isn't that one of the outstanding criteria of distinguishing particles from the physical analyses?

A. Yes, sir.

Q. You did not do that?

A. No.

Q. What is the index of refraction for lead carbonate, do you know that?

A. I don't know.

Q. You didn't look that up?

A. No.

Q. And you didn't compare that with these large particles that you found?

A. Lead carbonate?

Q. Yes.

A. Not at that time.

Q. Well, have you ever compared the index of refraction of lead carbonate?

A. I have done nothing on index of refraction.

Q. Are these third type particles that you have drawn in a rough sketch in your notebook uniaxial? We are dealing now with the question of how they are to be viewed under these polarized or unpolarized lights.

A. I don't know the crystal structure of these particles at all.

Q. Is lead carbonate uniaxial?

A. I don't know, I am not acquainted with the crystalligraphy of lead carbonate.

Q. Is lead oxalate uniaxial?

A. I am not acquainted with the crystallography of any of these lead compounds.

Q. Isn't yellow PbO biaxial?

A. I cannot answer.

Q. Now the subject of valences, you went into that?

A. Yes, sir.

By The Court:

Q. Could you tell me in a very few words what is the index of refraction? What is meant by that expression?

A. Well, roughly, it is tied up with the amount of change in direction of light when it passes through materials.

By Mr. Whitcomb:

Q. And each different substance has a different index of refraction, does it not? That is a recognized method of determining—

A. That is one of the properties of crystals, yes.

Q. Referring to valences, now, why does manganese have a valence of 7, 4, 6, 3 and 2 in different combinations? You know that it does, do you not?

A. Yes, sir. Well, to explain that question we would have to go into the electronic structure of the atom.

Q. But you are willing to admit that certain substances, particularly manganese, for one, and others, do have these different valences?

A. Oh, yes, sir. That is a well-known fact.

Q. Can you positively say that any chemical element in a certain periodic group, or having a certain value, cannot have another valence in its compound?

A. I don't believe I get the gist of that question.

The Court: I don't know what you mean by "in a certain periodic group".

MR. WHITCOMB: Well, that is the valence, again, and the atomic weight.

THE COURT: All right.

MR. WHITCOMB: The periodic group; all substances, as I understand it, are divided into these chemical groups, due to the atomic weights.

THE COURT: All right.

MR. WHITCOMB: That is one first classification.

THE COURT: Well, just the word "periodic".

MR. WHITCOMB: Yes.

By MR. WHITCOMB:

Q. What I am asking is, we know a certain valence of a chemical element. Now, it enters into combinations?

A. Yes, sir.

Q. Now, can you positively say that all chemical elements do not have a different valence when they enter into a new combination of the element, an oxide or some other compound?

A. I am sorry, I don't understand the question the way it is put.

Q. What part don't you understand?

A. Well, this different chemical valence when it enters into a compound; different from what?

Q. Different from what it has, as an element, per se?

A. Oh, absolutely, the valence of the element is zero, in any compound they are some number; lead coming into monoxide becomes two, into the peroxide it is four, in free lead it is zero.

Q. Suboxide, what would it be?

A. If suboxide exists it would be a valence of one, that is, if suboxide has the formula Pb_2O. If the suboxide had some other formula, of course, it would be a different valence.

Q. Then you admit that many elements might have one valence and then enter into a compound and have other valences?

A. Yes, I can give you a list of some—

Q. Yes.

A. — forty or fifty of them; more than that, all except those in the zero group.

Q. Yes. Assume solutions of lead acetate in two vessels, one heated, and one not heated, connected by electrical wire. Is there a current? There must be the lead electrode. The current passes, is that right?

A. Different concentrations of lead acetate?

Q. Same concentrations, but different heats.

A. One heated and one not—I cannot swear to the answer to that. I think that is tied up with some so-called effect in physical chemistry, but I don't remember the name and I am not sure of my facts on that.

Q. I am advised by Dr. Clark that it does. Do you think that would be sufficient in that case?

A. I think probably that is sufficient. He probably could tell you the name of the effect.

Q. If that is true what would it indicate, particularly with relation to the formation of the acetate? To be more specific, does it form a mono-acetate?

A. I am not acquainted with the reaction. I don't know.

Q. Now, coming to the subject of densities, how do you determine the density of a substance?

A. It varies according to the type of substance which we have. Solids, you mean?

Q. Yes, powder sample like we are talking about here.

A. You want me to describe the method of determining the density of lead oxide?

Q. Without going into too minute detail, yes.

A. The method we used was to use a small bottle with a very fine capillary neck, called a pycnometer. The neck was removable, tube, so that we could place —so that we could easily get the powder in, treat it with some good wetting agent, we used toluene, evaporate off the toluene and repeat that many times until we were sure that the air had all been displaced; fill the tube up to a certain level with toluene, control the temperature accurately, weigh the certain volume, and calculate its density.

Q. All right, doesn't the packing make a difference in the density, I mean, the natural packing that would take place?

A. No, sir.

Q. Why not?

A. Because this wetting agent penetrates in between the particles of the solid powder and fills up all the interstices.

Q. But does the particle size make any difference?

A. Not within the limit of error of which a determination of this type is made.

Q. You say the liquid penetrates the different cracks and crevices?

A. Yes, sir.

Q. Would your density measurements of fifteen or twenty different samples of one test lot all be the same?

A. They check very, very closely. Dr. Ullmann has the data on that. I don't have it.

Q. Close enough so that an addition of, say, four per cent. of suboxide, assuming it exists, would be detected by this—

A. You cannot answer,—

Q. —and not be within those variations?

A. You cannot answer that question unless you know the density of the suboxide. It should be possible to calculate the density of the suboxide from X-ray diffraction patterns, if you have X-ray diffraction patterns of the suboxide.

Q. Well, is it your opinion that four per cent. of such a calculated density in such a suboxide would be able to be detected by your methods of measuring the densities of these samples?

A. You cannot answer that question until you have found out what the density is, first. If the density should come out to be identical with the lead oxide, why, of course, there would be no difference.

Q. Then, at least, in that instance you would not be able to detect it by that method?

A. If there is no difference you could not detect a difference.

Q. Well, there might be a small amount of difference?

A. There might be a large amount of difference.

Q. And only four per cent. of the added material would give you a range of what variation?

A. The question cannot be answered unless the density of the material is known.

Q. What was the source of lead in the so-called synthetic mixtures you made, lead and lead oxide, in the different tests you described?

A. In density work?

Q. No, in any work, it is not limited, this is not limited to density, now. You testified about making

up some samples of metallic lead and lead oxides, did you not?

A. I don't recall testifying to that.

Q. You referred to Dr. Ulhmann, then, making some tests, is that it?

A. I don't recall testifying to any synthetic—test made on synthetic mixtures. I may have, and it slipped my mind.

Q. Well, did you make any such tests?

A. No, sir, I did not. Dr. Ulhmann may have. I think probably what—where the confusion arises is that I referred to the density of a synthetic mixture in which the density was calculated from known values of lead and lead oxide.

Q. Well, but did you actually use metallic lead?

A. We did not make those measurements, we used values from the International Critical Tables for the density of lead and the density of lead oxide.

Q. Now, in connection with the question of amalgamation, assuming the existence of a suboxide as testified to by Dr. Clark, would the mixture of such an addition of, say, four per cent. to the material you used do substantially the same thing you testified to with respect to the amalgamation

A. Do you mean could a—could four per cent. lead suboxide be determined by the method?

Q. That is what it amounts to.

A. That is the—

Q. In other words, could you detect a difference of four per cent. added amount?

A. Yes.

Q. Wouldn't it go into the amalgamation?

A. Lead suboxide amalgamate in mercury? I believe not. Berzelius's reason for postulating lead suboxide was that it would not amalgamate.

Q. You disagree with Berzelius, then?

A. No, I think it would be a very peculiar chemical compound if it did amalgamate. I think of no other oxides that amalgamate.

Q. If it did amalgamate then your test about the mercury would not prove any scientific fact about this, would it, because you would be getting out your lead, then, and would have an unknown substance right in with the lead result, isn't that true, the same as on the other end, if you tried to separate the oxide from the mixture, and you get all oxide, you don't know whether there is a proportion of PbO, or possibly—and possibly other oxides, so that unless you know that lead suboxide does not amalgamate—

A. Just a minute, please,—

Q. — with mercury you haven't proven anything?

A. Just a minute. What is seven per cent. of four per cent.? Two thousandths of a per cent. would be the amount of oxygen in four per cent. of lead oxide which would be present, since there is seven per cent. of oxygen in lead suboxide. Consequently, I don't believe that we could detect the difference of two thousandths of a per cent. of oxygen in the amalgamation process.

By The Court:

Q. Is that two thousandths of a per cent., or two thousandths of the whole?

A. It is four per cent. of seven per cent.—of seven per cent. of four.

Q. Well, either way.

A. No, four per cent.—

Q. Either way.

A. Either way; point two zeroes twenty-eight.

Q. That is the whole, though, that is not of one per cent., that is two thousandths of the whole?

A. Of the total sample.

Q. Of the total sample, yes.

A. Yes.

Q. But not two thousandths of one per cent. of the total?

A. No.

By Mr. Whitcomb:

Q. No, I think the judge is right, isn't he, Dr. Ewing?

A. Yes.

Q. .002 of the whole?

A. Yes.

Q. Because you have already taken your percentage of your percentages?

A. Yes.

Q. Will you please now refer to Defendant's Exhibit 179 and state how you know that lead is in the colloidal state?

(Defendant's Exhibit 179 was shown to the witness.)

A. In particle size determinations under the microscope the photograph is taken of the dispersed particles and measurements are made upon these photographs and suitable calculations made to determine the diameter. If the particle is of the range of a tenth of a micron, due to the nature, or, due to the wave length of light, it is not possible to sharply resolve these particles of one-tenth of a micron in diameter under the microscope. That is a limitation Nature has imposed. Consequently, in determining these particle sizes when we come to a particle which gives a faint blur on the photograph, a blurred point,

we automatically assign to that a value of one-tenth of a micron. It may be smaller. We cannot tell.

By Mr. Whitcomb:

Q. But how do you know that that might not have been—

A. I find these blurred particles on the photograph.

Q. Yes, that is true, I understand you do, but the question is, how do you know it is lead? Might it not be just as well suboxide?

A. Why, I stated that I—when these pictures were taken the particle undoubtedly was no longer lead. The original particle was lead when I made the mark, but these fine particles oxidize very rapidly in the air, and I made the further condition that they might grow when they are oxidized, but it is hard to conceive that the size would diminish with addition of oxygen to it.

Q. That is all very true.

A. Yes.

Q. Then your testimony now is that you don't know that that is lead?

A. My testimony is, was and is that the particle originally was lead, as far as I—

Q. Now, we will come to that in a moment.

A. — can judge from my method of preparation.

Q. Then your testimony now, or at any time, is that you do not believe it is lead in that picture, Exhibit number 179?

A. Yes.

Q. But I thought you were undertaking to show that metallic lead particles in contradistinction with Dr. Wilson's report could not exist in such a small size.

A. My testimony was that they can be made by grinding and were made on the paper by grinding, but after they were made they immediately oxidized. I cannot prove that they immediately oxidized, but that is the property of finely divided lead, that it will oxidize in air.

Q. Well, now, all right; come to the question of your paper. This was when you put a lead mark on a piece of paper.

A. Yes, sir.

Q. Didn't that generate a heat and raise the temperature?

A. No.

Q. You are sure of that? Do you know that lead—

A. It may have generated a temperature of a thousandth of a degree or less.

Q. Are you willing to swear positively that that was lead on the paper, and not an oxide of lead?

MR. MORRIS: You mean what was put on, or what was there after what was put on was on?

MR. WHITCOMB: What was on after he got it on.

MR. MORRIS: He has sworn twice that he believed it to be an oxide.

MR. WHITCOMB: I am asking him.

MR. MORRIS: No, I know, but this is repetition. He said in his direct and now that it was an oxide in his belief, and, furthermore, I am objecting because the assumption, the inference to be drawn from the question of the learned counsel is contrary to the evidence.

THE COURT: Well, the only thing that I see

about it is that it is probably repetitious. Let's get it settled finally.

By THE COURT:

Q. What is this, what was on the paper immediately after you drew the lead—

A. To the best of my knowledge and belief, it was lead.

Q. And not lead oxide?

A. And not lead oxide, made by rubbing a piece of lead which had been very carefully cleaned on emery paper.—

Q. All right.

A. — and other paper, and lightly marked on this.

THE COURT: Well, that settles, at least, it settles your testimony.

By MR. WHITCOMB:

Q. Wasn't there a film of oxygen on the paper?

A. Yes.

By THE COURT:

Q. Now, you also said, as I understand, that it did not remain lead very long, or did not remain lead—was not lead at the time it was photographed?

A. Not the time it was photographed, no.

Q. And what was it at the time it was photographed?

A. It was an oxide of some kind, undoubtedly.

THE COURT: Well, all right.

By MR. WHITCOMB:

Q. Now, Dr. Ewing, Plaintiffs' position, as you certainly know, is that Dr. Clark has testified that

he himself has found a suboxide and thoroughly believes there is one.

A. Yes, sir.

Q. Well, now, I would like to ask you, with that in mind, from your point of view that you make the assumption that there is suboxide, and then state whether or not all those eight rates of action going on as testified to by Dr. Clark would be true or not. This is a hypothetical question, of course.

A. Well, I can knock out one of them at once. I don't believe that the second one is right, whether he assumes—that is the rate of the blast controls the thickness of the absorbed film.

By The Court:

Q. You mean whether there is or is not such a thing as lead suboxide there,—

A. Yes.

Q. — that still would not be true.

The Court: All right.

By Mr. Whitcomb:

Q. Well, do you know the standing of Walker, Lewis and McAdams, "Principles of Chemical Engineering"?

A. Yes.

Q. Is it a recognized—

A. Standard text book.

Q. Well, on page 38 it says:

"If the main body of the fluid be flowing over the surface of the solid or liquid, a rolling or turbulent motion will exist at the surface of the boundary film, and this will wear away or rub off a portion of it, causing what amount to convection currents to strike more deeply into it.

The thickness of the film is thereby decreased and any action resultant upon the presence of the film will be influenced accordingly."

Do you agree or disagree?

A. I would have to know when he said thickness of film, whether he meant adsorbed film or not. If he means adsorbed film I will have to disagree. If he means a film that is on there by wetting, why, he is probably right.

Q. Well, then, as long as there is a film there you agree that he is right?

A. No, sir.

THE COURT: He says if it is an absorbed film he disagrees.

By MR. WHITCOMB:

Q. Excepting you make the distinction if the film is absorbed it would not be correct?

A. I don't believe "absorbed" is the word.

Q. "Adsorbed", I beg your pardon; could there be a film there that is not adsorbed?

A. Yes.

Q. And then in that event—

A. The same as you could have a film of water on the sidewalk, it is not all adsorbed water.

Q. Well, might that not be going on in these mills? Isn't there a sweeping over each particle in some part of the action?

A. Not affecting adsorption.

Q. I am not talking about adsorption.

A. All right, there is air going through the mill, I don't know—

Q. Well, then, would this be true, that "the thickness of the film is thereby decreased and any action resultant upon the presence of the film—

THE COURT: Well, but, Mr. Whitcomb, Dr. Clark, as I understand it, the film he was talking about was absorbed film, nothing else, wasn't it? What is the use of examining about something else that was not—

MR. WHITCOMB: Well, of course, there is a question of how much, whether it is totally absorbed—

THE COURT: Well,—

MR. WHITCOMB: — or combined film, I don't know.

THE WITNESS: Well, adsorbed and combined film are practically synonymous terms.

By MR. WHITCOMB:

Q. In any event, you do not disagree with this statement in this paper, with the limitation you put on?

A. With the limitation I put on, I do not disagree.

THE COURT: They want to change stenographers at this point.

WARREN W. EWING, recalled.

Cross-examination (Continued).

By MR. WHITCOMB:

Q. Well, then, on all the other seven actions you agree he would be correct in that, or what is your testimony?

A. I didn't get that far, you interrupted me.

(Discussion off the record.)

THE WITNESS: Of course, the third has nothing—well, the third has nothing to do with the postulation of Pb_2O.

By MR. WHITCOMB:

Q. Well, what is your answer to that, then, about the third?

A. Why, I agreed to that in the beginning.

Q. Yes. All right.

A. The fourth for you to postulate is that the reaction of oxygen on lead is the formation of lead suboxide. Of course, there will be a rate of chemical reaction, the action to adsorb, or the action of adsorbing oxygen on lead.

Q. Then you agree with Dr. Clark on that under this hypothesis?

A. Under this hypothesis, yes. The rate of diffusion of oxygen throughout the protecting layer of PbO has nothing to do with lead oxide.

Q. You agree that that happens?

A. I agree that there is a diffusion there, and I believe there is some condition about the rate of removal by abrasion—the rate of removal by abrasion has nothing to do with Pb_2O—and I agree that there must be a rate of diffusion, the date of disassociation.

Q. Of suboxide?

A. Suboxide, Pb_2O. Wel, there is a little—there's a lot that can be said on that, but I don't believe it is worth while. If Pb_2O exists and if it decomposes according to the postulated theory, why, of course, it can be decomposed at the given rate—and which is, in my opinion, very close to molecular lead. The fourth for PbO—

Q. What's the fourth?

A. Not the fourth, the eighth. The rate of oxidation of Pb_2O—if Pb_2O exists and if it oxidizes rapidly in the air at the temperature of the mill, of course, there must be a rate of oxidation.

Q. I believe you made certain deductions with respect to this powder when immersed in a film of water or in water. State what was the condition of the sample.

A. Are you referring to the finding of these crystals under the microscope after the substance had been placed in water?

Q. Yes, when it is completely submerged and so forth?

A. Yes, sir. It was a little of the gray oxide placed on the point of a knife, it was shaken on the microscope slip, covered with water, stirred around with a glass stirring rod, lightly smeared out, and allowed to dry—ideal oxidizing conditions—and then the dry material examined under the microscope.

Q. Did you try heating any of the powder?

A. No, sir. But, if it were the red lead oxide and we heated it to the transition temperature, it would then go into the yellow oxide, and you would have a blackened effect on the surface due to the crystalline change.

Q. At what temperature would that be?

A. I believe it came up in Court yesterday that that transition temperature was 585 degrees—I'm not sure.

Q. It was very high anyway. Centigrade?

A. Centigrade, yes. 585 degrees.

MR. MORRIS: That is all.

MR. MORRIS: That's all, Dr. Ewing.

THE COURT: Did you find out about that supplemental report of Dr. Wilson's?

MR. MORRIS: It is all right. If he made a supplemental report, with respect to his second examination, it would be but a repetition of what is already disclosed in the original report. If he found anything different at all—if he finds anything different at all, I will be glad to have it shown.

(Discussion off the record.)

MR. WHITCOMB: Of course, in that connection remember, your Honor, we have got the testimony in of those old records, showing how it would drop off in an hours run of several hundred.

MR. MORRIS: Incidentally, I think the record should show that the day your Honor visited the plant with Dr. Wilson—which, as I recall it, was on Thursday morning of last week—Dr. Wilson brought back a number of bundles of the record, which the Plaintiffs now have in their possession—

MR. WHITCOMB: That's true.

THE COURT: Yes.

MR. MORRIS: — and that those—I think it should also show that those were selected by your Honor or by Dr. Wilson at random.

THE COURT: No, I didn't select them and I didn't see them selected, but Dr. Wilson states that they were selected at random by him.

HARRY W. ULLMANN, was called as an expert witness on behalf of defendant and having been first duly sworn, testified as follows:

Direct-examination.

By MR. MORRIS:

I am head of the Department of Chemistry at Lehigh University. I have occupied that position since 1913, I think it is. Yes. I am a graduate Ph. D. of the John Hopkins University in chemistry. I didn't occupy any position of any account between the date of graduation and going to Lehigh. I was a student. I have formed an opinion as to whether or not there is any lead suboxide to be found in the Defendant's product. My opinion is that the defendant's product does not contain lead suboxide. My opinion, from all that I have read and from the things I have done myself and from the testimony that I have heard, is that there is no such compound as Pb_2O.

Q. Will you proceed, in your own order, to tell me why you arrived at those conclusions?

A. In approaching a topic of this kind, we naturally consult literature on the subject. There is no use going back to Berzelius, Pelouze, and Bouissingault, who worked a hundred years ago. In this particular case, as I understand it, the evidence of the plaintiff is submitted from zero. As we look through the literature, we find a number of statements about lead suboxide, we find that a more recent—we find that the more recent statements, made particularly when men have had the advantage of X-rays—we find that that testimony, with the exception of the testimony of Ferrari and the testimony of Dr. Clark, made by men of the highest rank, is to the effect that lead

suboxide either does not exist or that they could find no reason for supposing its existence.

This work goes back to a number of men. We have the work of Le Blanc and Eberius, Le Blanc being one of the greatest chemists in the world. We have the work of van Arkel and we have the work of Darbyshire, who was the leader of all X-ray analysts, and Professor Bragg, and cannot find any reason for supposing that there is the compound lead suboxide. We have the opinion of Friche and Ackerman, who did a great deal of work on the subject, who go so far as to say it is time to strike all reference to lead suboxide from the literature. We have the work of Dr. Davey and the work of my colleague, Professor Anderson, who likewise say it is impossible to find the substance.

I should like to go through this in some orderly fashion, due to the fact that I may not pass through the whole of what I want to say, and I shall try to be as brief as possible.

THE COURT: Pardon me, we can relieve you by having your notes read by someone else. You are perfectly free to ask Dr. Anderson or anyone you wish to read.

THE WITNESS: Thank you, sir. I will try to have enough voice to last through the cross-examination.

MR. WHITCOMB: Yes.

By MR. MORRIS:

Q. Won't you proceed, Dr. Ullmann?

A. In the first place, the matter of color has been brought up—as to why the material made of a blue-black substance like lead and the red substance like

tetragonal lead oxide should be green. Of course, when tetragonal red oxide of lead is ground fine, its color is yellow and the finer it is ground the lighter yellow it becomes.

I have here an exhibit, in this little box, which contains, in the first place, at the top here, fine metallic lead, and the next is red oxide of lead—and when that red oxide of lead is ground it becomes a light yellow, and if we mix this light yellow lead oxide—

Q. Will you pardon me just a moment?

A. Yes.

Mr. Morris: I ask that the exhibit to which Dr. Ullmann is referring be admitted in evidence as the Defendant's Exhibit 180.

(Box containing card was then marked as Defendant's Exhibit No. 180.)

By Mr. Morris:

Q. All right. Will you proceed, Dr. Ullmann?

A. Well, at any rate, when we mix this red oxide of lead that has been just ground—ordinarily, in a mortar—with fine metallic lead, then we can get various shades of green, any shade that we like. I have chosen those two shades as being, as approximating, the Defendant's oxide. If you like, they can be lighter or darker. Those, as you can see, are olive green.

The next—I will try to be as brief as possible—the next matter I should like to bring up, also a physical test, is the determination of density, the specific gravity, of the Electric Storage Battery Company's gray oxide. These determinations were made with the greatest care. We found early it was necessary to remove, as far as possible, all adhering air and, if possible, any absorbed air from the surface

of the oxide and also from the surface of the materials that we used as standard.

This was done in a recognized form of apparatus. The air was removed by treating the materials with a substance that would wet it like toluene, of a high purity and perfectly dried, of course. The toluene evacuated and this was repeated, and then the density was determined in toluene by well-recognized methods.

The samples examined were official samples under the screen finished product—two different dates—one phosphorous pentoxide and the other one not. As to the agreements of these densities with the densities calculated for mixtures of this type, the agreement is excellent.

If I may explain for a moment, we determined, analytically, the percentage of lead and lead oxide in this substance, and then we weighed the substance with its gravity and weighed the lead oxide with its gravity, taking them pro rata—that was to find out what the calculated gravity should be—and we find it is very, very close. I have made a calculation here, because I imagined it would come up, of what the effect would be if the substance—if this contained some known substance. Of course, I would have to take some substance of which the gravity was known, and I took, because it had been mentioned in this case, lead carbonate, which has a gravity of about 6.6, and I calculated that our method used would have discovered as little as two-tenths of one per cent. added to this mixture—that is, the addition of as much as two-tenths of one per cent. of lead carbonate would have vitiated the results that we got.

By The Court:

Q. Well, you could probably answer the question

I have asked several times here, and that is if I give you a mixture and tell you it contains nothing but lead and oxide of lead, can you satisfy yourself absolutely that that is correct?

A. Yes.

Q. By your tests?

A. Oh, yes. Yes.

Q. By chemical analysis?

A. We can also do it by chemical analysis.

Q. You can, by chemical analysis, in other words, establish conclusively that a mixture has nothing but lead and lead oxide or some lead oxide?

A. Yes. The way we do that is we determine the lead—

Q. Yes.

A. — and, independently, the lead oxide; and, if that adds up to within, two, three, or four-tenths of a percent.—of a hundred—we take it for granted that we have covered the constituents.

Q. Can you, then, by chemical analysis, tell what oxide of lead it is?

A. Well, if it had lead oxide in it, you could tell that by chemical analysis, yes.

Q. I was just wondering what was the fullest report you could give me, by chemical analysis, on a compound which I hand you and say I believe it contains lead and mixed with that some oxide of lead which I don't know or can't identify, what will be the fullest report you can give me?

A. I would like to have you specify, in order to save time, that it is a mixture, say, of lead, lead oxide, and the specious lead suboxide. Of course, if it is not any real lead suboxide, I can't determine it. As a matter of fact, I haven't thought it worth while to attempt an analysis of this type.

Q. I understand, but I just—

A. Yes. It could be done, anybody could do it.

Q. — wanted to know, can you identify the oxide that is present?

A. From an analysis, you could identify not only that it was present but even determine the quantity present.

Q. Of any oxide?

A. Now, you say "any oxide",—of course, I will have to think. Any known oxide, yes.

Q. How much of the mixture was lead and how much was oxide?

A. Yes, you can tell it, if it had lead suboxide, and if you would like to have a demonstration of that—

MR. MORRIS: If you will explain—

THE COURT: Oh, I understand it.

MR. MORRIS: But I am sure Dr. Ullmann will explain how he does that as he proceeds.

THE WITNESS: If you would like to have it—

THE COURT: Well, I don't know. As far as I am concerned, I accept your statement that it can be done. That's what I have been trying to find out.

MR. WHITCOMB: We are informed that it cannot be done.

(Discussion off the record.)

By MR. MORRIS:

Q. Will you proceed, please, Dr. Ullmann?

A. Well, I neglected to say, in qualifying, that for a long time I occupied the same position at Lehigh that Dr. Clark does at Illinois, in regard to quantitative analytical work.

I have here a lot of details that won't interest you—for sample, calculation for density—which I suppose we can leave out or will it, possibly, be taken for granted?

THE COURT: Go ahead.

By MR. MORRIS:

Q. Yes.

A. In view of the excellent testimony given by Dr. Ewing, I can pass over the mechanical separation of Pb from—that's the E. S. B. gray oxide. It can be shown that all these tests point to a mechanical mixture of lead and lead oxide.

Q. Any kind?

A. No. E. S. B. gray oxide.

(Discussion off the record.)

By MR. MORRIS:

Q. Proceed.

A. I next come to the problem of amalgamation. This is an old topic in this field. From our experience in density determinations and from what we know in general about substances, we decided that we might be able to amalgamate all the lead out of the E. S. B. gray oxide by following a careful technique and freeing the E. S. B. gray oxide from air, so that the amalgam might touch the lead.

You understand, of course, that there is a layer of air on many kinds of materials. That explains, for example, why when you drop water on fine material like dust on the floor the drop of water goes over the floor and does not wet the floor on a dusty floor. If you take the air off the small particle of dust, why the water will wet the dust.

This was carried out on the E. S. B. gray oxide

by methods which we shall publish in the literature —we are assured that what we submitted for publication will be published in the literature—and we find that E. S. B. gray oxide gives results of lead by amalgamation which agree very closely with the determination of lead by analysis. That is, we can actually pick the lead out with mercury and get it all. All that is shown by analysis.

This, furthermore, confirms the view that E. S. B. gray oxide is simply a mechanical mixture of lead and lead oxide, and again explains all its properties in respect to amalgamation just as it explained, fully and in a perfectly satisfying way to a chemist's mind, that it was nothing or is nothing, simply, but lead and leadoxide, as determined by the density measurements. I may here say that we tried every method—

Q. Dr. Ullmann, will you pardon the interruption—

A. Yes.

Q. — because I didn't get clearly from your amalgamation process your complete results—now, if you said it, I missed it—you dealt with the amalgamation which picks out the lead, but you have not analyzed the remainder nor have you mixed your two ingredients and then analyzed them in the same way?

A. Please get me—I think it's in the box—it's that little amalgam tube. Will you get it, please?

(Discussion off the record.)

THE WITNESS: The method of analysis which, I say, we shall submit as a scientific publication—

By THE COURT:

Q. May I ask if this a new method of analysis?

A. Yes. No one has ever amalgamated any of these products before, to my knowledge.

By Mr. Morris:

Q. The reason they could not is, as you conclude, what, Dr. Ullmann?

A. Why, they haven't taken the pains to remove the air from the surface of the lead and the lead oxide.

Q. Then you found, when you took the pains to do that and thus treated it with mercury—when you take the necessary pains to do that and then treat it with mercury, it will amalgamate?

A. It amalgamates completely, yes.

Q. If you will be good enough, Dr. Ullmann, tell me how you know whether the remainder of your original mixture is PbO or something else—that is, when you get to it? That's what we are getting to now, is it?

A. Yes.

Q. All right.

A. Do you want the—the remainder of the mixture is PbO—the PbO is rather distributed and it is difficult to collect it all and find exactly how much of the PbO is present. What we amalgamate, of course, is the lead, and we find that the lead agrees wholly with the analysis we make, showing—

By The Court:

Q. You don't actually collect the residue and analyze that—you subtract the lead from your prior analysis figures?

A. No. We actually determine the lead—

Q. Yes.

A. — actually weigh the lead we got in the mercury—

Q. Yes.

A. — and that agrees with the lead that we get by analysis.

Q. Yes. I am correct in saying you don't collect the residue and make the—

A. We can't very well collect it. I imagine, if we worked carefully enough, we could but we didn't think it was worth while.

By Mr. Morris:

Q. But you do ascertain, Dr. Uullmann, do you not, what the remainder of that mixture was or is?

A. That mixture—

The Court: Well, now, he ascertains it before he starts in. Don't you.

Mr. Morris: I don't seem to be able to get the thought that I have in my mind over, but he does ascertain it, and I would like for him to tell us how.

The Witness: Why, what we do, if we like, is to dissolve the rest of the mixture in acetic acid and show that it dissolves wholly. When we have done that—

The Court: You didn't do it in this case?

The Witness: Oh, yes, we dissolved it in this case; but we don't try to collect it in a quantitative way.

By Mr. Morris:

Q. Is it that you take two samples from the same batch and then you treat one with lead and you treat another—you treat one with mercury for amalgam?

A. Yes.

Q. And treat another sample from the same batch with acetic acid?

A. Yes.

Q. That's what we want to get, Dr. Ullmann.

A. Yes. Thank you, very much. These two results, one I get by analysis, PbO, and the one I get for this—

Q. Pardon me, Dr. Ullmann.

A. It's too bad we haven't had a conference about this.

Q. Now, then, did you make a synthetic mixture of lead and PbO and, if so, did you analyze that and what comparable results did you get that were comparable or otherwise with your gray oxide tests?

A. Well, I will have to go back a bit. This is a very difficult operation. In the first test, we could n't get total amalgamation, and then there was no method known which was working satisfactorily for determining, analytically, how much lead there was in this large quantity of mercury. And, while we weren't getting very exact results, we did put together a synthetic mixture, but that synthetic mixture didn't give us wholly satisfactory results about the lead, simply because there was no analytical methods known at that time. Since we have had this very accurate method, it really has not occurred to us to make a synthetic mixture. It is absolutely useless, as a matter of fact. No chemist would ask me to do it.

Q. That means to a layman what? What percentage of lead did you get by your amalgamation of the gray oxide?

A. The percentage of lead, by amalgamation—this is an official sample—26.48 and the lead, by analysis, was 26.68.

By The Court:

Q. Per cent.?

A. Per cent., yes, sir. Now, we took the precaution, of course, of determining this 26.68 per cent. lead by analysis, not simply by difference but actually determined it as lead, as well as determining it—as well as checking that by subtracting the PbO from a hundred.

In another case, we have lead, by amalgamation, 33.92 per cent.; lead, by analysis, 34. 27.

Another case, we have lead, by amalgamation, 33.25; lead, by analysis, 33.

I think it might be well, just for a moment, to indicate the method so that my chemical friends here can be satisfied with it. The mercury—

THE COURT: I think, perhaps, we had better reserve that until after lunch. It is half past twelve now, and we can start right at that point. Court is adjourned until two o'clock.

(Recess, 12.30 to 2.00 P. M.)

AFTER RECESS.

Present: Counsel as before noted.

HARRY M. ULLMANN, recalled.

Direct-examination (Continued).

By MR. MORRIS:

Q. Will you proceed, at your convenience, Dr. Ullmann?

A. We are going to give some brief description of the actual method of amalgamation and analysis used. The material to be amalgamated is put into a tube like this (indicating); and then mercury is put in, and it is exhausted, and toluene put in, and exhausted repeatedly.

By The Court:

Q. What do you mean by exhausted?

A. Oh, put a vacuum on it, to draw off the air and the toluene.

Q. And the mercury, what do you draw off then?

A. The mercury is heavy, and stays in the bottom. This tube is evacuated still.

Q. Yes.

A. There is no air, at least, very low vacuum in it.

Q. Yes.

A. You draw the air off.

Q. Yes.

A. And the toluene, wetting the material, helps to draw the air off the outside of all this substance.

Then mercury is put in. Then it is put in a shaking machine, and depending on the amount of air that is left on it, on the material, it is shaken in a machine like that (indicating). It has to be shaken quite a while to get a thorough amalgamation.

By Mr. Morris:

Q. Of what?

A. Thorough amalgamation of the lead and the material.

By The Court:

Q. With the mercury?

A. With the mercury. That is sealed like that

(indicating), they are strapped on to a little machine, it has an eccentric motion, like that (indicating).

Q. Yes, I understand. and what is this mixture that is in this tube?

A. That is the original gray oxide, mercury in it. The mercury in this picks up the lead, amalgamates the lead, and this other material is there, of course, is the rest of the material, the lead oxide.

Now, having gone that far in our earlier tests we had one great difficulty in determining a comparatively small amount of lead in a great deal of mercury. It is a very difficult chemical, analytical operation. In the later development of the method we simply drove off some of the mercury in a vacuum until we had a very small amount of mercury and amalgam, and we dissolved that, that could be—and the mercury dissolved in sulphuric acid. It seems that acid sulphate of mercury is soluble in sulphuric acid.

By Mr. Morris:

Q. Sulphuric or nitric?

A. Oh, it is a residual—it is one step, I omitted one step there. The mercury and nitric acid, the mercury, amalgam and the mercury are treated with nitric acid and dissolved, dissolving both mercury and lead; and then it is treated with sulphuric acid. The acid sulphate of mercury is soluble. The lead is precipitated as lead sulphate and determined in the usual way, with the usual precautions, and using water saturated with lead sulphate, and so forth, and so forth. In that way we get a determination of the lead that is amalgamated very accurately.

For our own use and purpose of publication we made synthetic mixtures of pure lead and mercury, knowing the amount of lead that we put with the mercury, then went through this same treatment and

recovered all the lead that we put in, showing the method of separation and analysis is a good method.

Dr. Ewing has covered pretty well the subject of microscopic examination, together with the treatment of the gray oxide, so that it might be properly examined.

I have here an experiment which will illustrate how readily the mixture of toluene, with a small amount of lecithin—

By The Court:

Q. Small amount of what?

A. L-e-c-i-t-h-i-n, lecithin—separates the oxide from the lead that has been shaken up. See how rapidly the lead settles, and this up here, now, is mainly lead oxide (indicating). There re figures given as to just how much that is. This, if I may say so, Your Honor, without attempting to be facetious at all, is an equivalent of an egg shampoo. Lecithin is the material contained in the yolk of egg which makes it a good shampooing material.

Q. Yes.

A. The gray oxide is simply put in there without any further treatment and shaken up. It has not been shaken much at all, see, the lead settles very rapidly, indicating that pratically all the lead is a fair sized particle.

In the early stages of the examination we made microscopic observation of official samples of Electric Storage Battery gray oxide, and I have here some microphotographs at sixty diameters, indicating what we found, practically—

Q. These are not the same as Dr. Ewing's?

A. No, sir. These are going to bring out a little different point. These illustrate what could be

seen under the microscope, or what I saw under the microscope.

Q. Was that just the plain E. S. B.?

A. E. S. B. gray oxide, which has been—which has been carefully washed, and the lead oxide that is left on it, I tried to indicate by that bit of yellow color. That is all that is left on the sample. Now, it is important to notice—

Q. What are the large—are those lead pieces?

A. Those large ones are undoubtedly lead.

Q. Yes.

A. It is imortant to notice that those large pieces of lead are very much aroded and pitted. This large piece of lead in the center here was rotted, you see, and it was washed quite clean (indicating).

There is another material of the same kind. Here is another material of the same kind; piece of lead had been rotted through and through. Here is one that was focused on a little piece that for some reason—occasionally have a little piece that has a little yellow. Now, in the crevices—

MR. MORRIS: May I pause just a moment to offer these collectively as Defendant's Exhibit 181? There are five, so they will be numbered 181-A, B, C, D, and E. There is no 181 flat.

(Five microphotographs produced by the witness Ullmann were marked, respectively, Defendant's Exhibit 181-A, 181-B, 181-C, 181-D, and 181-E.)

THE WITNESS: There is a legend on the back of each one of those indicating what can be seen.

I don't think that I need go into the subject of coagulation of lead by acetic acid at this stage. In one other trial that was held in this

subject there was a good deal of attention paid to that, but we have found that samples of lead in general, for example, lead that you buy in the market, very fine lead, when treated with acetic acid cleans up the lead, of course, cleaning off all the oxide, the little that is there, and then the lead forms a spongy mass. That is a property of lead.

There are some statements in the literature that lead suboxide is indicated, and they are erroneous statements, by the fact that a solution of sugar, a concentrated solution of sugar will dissolve lead oxide, but would not dissolve it out of what was then stated to be lead suboxide. This was thought to be an interesting test, and we examined these samples of official E. S. B. gray oxide by this method. According to that method the specimen of E. S. B. gray oxide is put into a container of some kind and is stirred with a solution of sugar. The lead, of course, is not dissolved and can be determined. This was done with the E. S. B. gray oxide, and we find that the lead from the sugar treatment, which is probably simply a dispersion of PbO, that the lead found in the sugar treatment agrees excellently with the lead found by analysis. Thus, again, we have pulled lead and lead oxide apart out of E. S. B. gray oxide, the lead oxide corresponding to all the lead oxide that can be found by analysis, leaving no room, as in the other cases, for any, any appreciable amount of any other oxide of lead whatsoever.

I am going over these rather rapidly. Ignitability; I think there is no use going into that. The statement has been made often that E. S. B. gray oxide does not continue combus-

tion when heated in air at one spot by the approach of a match.

As to reactivity, the reactivity is a measure of the fineness of particles in these related oxides, and we measured the reactivity of Electric Storage Battery gray oxide and that of the oxalate oxide made by heating lead oxalate in which the particles are admittedly very fine. We did this by exposing the samples at 165 degrees centigrade, which is about the temperature of the E. S. B. mill, I am told, and we find that the reactivity thus in air and against oxygen in the oxalate oxide is about fifty-seven times as great as that of the E. S. B. gray oxide. This has a direct relation to the fineness of the particles. We have done this a number of times, and I have here a table on which is a curve showing the gain in weight of oxalate oxide and E. S. B. gray oxide when exposed to air, ordinary laboratory air, at 165 degrees centigrade, which is about the temperature of the E. S. B. mill.

(The witness produced the curve.)

Mr. Morris: I offer the graph in evidence as Defendant's Exhibit 182.

(Graph showing gain in weight of oxalate and gray oxide when exposed to air at 165 degrees C, produced by the witness Ullmann, was marked Defendant's Exhibit number 182.)

The Witness: In our research covering all physical and chemical methods that we might use to identify this material we would naturally think of one that is one of the great constants of nature, and that is the heat of reaction, and we carried through determinations of the heat of re-

action of E. S. B. gray oxide with acetic acid. This was done with the usual great precautions. I have here a drawing of the apparatus in which it was done. I have here a full description of the methods by which the apparatus was standardized. It was not only standardized against chemically pure materials, but was also standardized through the reaction of hydrochloric acid and potassium hydroxide, by the well-known methods and standards established by the greatest authority on that subject, Theodore William Richards, of Harvard, and we have heats of reaction together with the tabulations all tabulated here, there is no use taking the time of the Court, and we have here the heats of reaction of the official samples, and these show that the heat of reaction of E. S. B. gray oxide corresponds to the heat of reaction that would be expected from the solution of a like amount of PbO in acetic acid, thus showing that the E. S. B. gray oxide is made up of lead oxide which in its heat of reaction corresponds very accurately with the heat of reaction reckoned according to the analysis.

We have conducted some other experiments, as follows: While we had no faith that we could form lead suboxide by heating together lead and lead oxide, for the reasons that we did not believe in the existence of lead suboxide, we nevertheless heated lead and lead oxide at various temperatures, heated them together at various temperatures from 150 degrees centigrade to 350 degrees centigrade, in twenty-five-degree stages. Those samples were then given to Professor Anderson to see if he could discover anything new in these samples, or if he could discover anything

to which might be ascribed lines which might correspond to a substance Pb_2O or any other new substance, and he found none.

We also carried on the oxidation of lead. If lead is heated with oxygen we would expect, if a suboxide could be formed, that we would get it at various temperatures, and we heated up until it was oxidized, about fifty per cent. of PbO and fifty per cent. lead, and we gave those samples to Professor Anderson to see if he could find anything unexpected in them, that would not be expected by any *good* chemist, and he did not, I understand, he told me, at least, he did not.

We furthermore reduced lead oxide with carbon monoxide, CO, thinking that in that way we might possibly make some lead suboxide, if such a compound were possible. We naturally did this, because it is supposed that one of the products of heating lead oxalate is CO. Those products were given to Professor Anderson, and he found nothing which would in any way indicate lead suboxide.

I should now like to turn to the question of fineness.

Mr. Betts: Your Honor, I did not want to interrupt while the witness was heading, but I think we should move to strike out that part of his testimony that refers to what he gave to Dr. Anderson and what Dr. Anderson reported to him.

The Court: The only trouble is, they will call Dr. Anderson back.

Mr. Morris: I have no objection to that part going out. Dr. Anderson has testified, so no objection to the motion.

THE WITNESS: The last time I said, at least he told me so.

MR. MORRIS: Yes.

THE WITNESS: All right.

MR. MORRIS: That is just a little against our rules of evidence, Doctor.

THE WITNESS: Yes, sir.

MR. MORRIS: So I consent that that part be stricken out.

THE WITNESS: All right, sir. I can read some of this.

E. S. B. gray oxide is not an extraordinarily fine product as industrial products go. It is not nearly as fine as the oxide from the decomposition of lead oxalate, Berzelius' so-called "suboxide", which, as I understand it, is the degree of fineness aimed at—although I am no patent expert—in the Shimadzu patent oxide, and which, I believe, is the degree of fineness claimed in a scientific paper by Mr Shimadzu. I refer, of course, to a paper he delivered before a congress.

Now, the great variance of the fineness of E. S. B. gray oxide from Berzelius' so-called "lead suboxide", is evident from its correspondingly lower reactivity, about 57 to 1, as shown by the data and curve introduced under the heading "Reactivity", which has been marked as an exhibit. The comparatively low grade of fineness of E. S. B. gray oxide as compared with Berzelius' so-called "suboxide" is also evident from comparison of microphotographs of the two products, which were submitted by Dr. Ewing.

E. S. B. gray oxide contains sixty-five per cent. of PbO as very fine particles, as seen in the microphotographs, and this would be expected of the normal product made by the reaction of Pb plus O equals PbO, when the PbO powder formed is rubbed off in a mill by attrition against lead balls or against masses of previously formed PbO.

Could I get Mr. Clocker or someone just to read this for a while?

THE COURT: Yes, sure.

MR. MORRIS: Now that there has been a pause, I should like to have your pages in dealing with the heat of reaction read into the record, or taken from your notebook and put in, unless they are put in.

THE WITNESS: There is a tremendous—there is a good deal of the description. I would be very glad to submit—

MR. WHITCOMB: Why isn't it all right to put them in as a written description?

THE COURT: I think it would be all right.

MR. MORRIS: Then I will get you to separate those after you conclude, if you will, Dr. Ullmann.

THE WITNESS: I will. Do you want the standardization by the method of Theodore William Richards, and all that?

MR. MORRIS: Yes, I would like to have your heat of reaction in the record.

THE WITNES: Very well, all right, sir.

(Mr. Edwin T. Clocker then read from the written report of the witness.)

Mr. Clocker: The metallic lead particles in E. S. B. gray oxide are in general not as fine as the accompanying PbO particles. This is apparent at once on looking at them under the microscope or on the microphotographs of gray oxide, or by looking at the lead particles obtained by washing away of the very fine particles of adhering PbO. The metallic lead particles are, however, of distributed sizes to be expected normally of a process proceeding in an orderly fashion by oxidizing the surface of lead balls in a rotating mill according to accepted principles of chemistry, lead plus oxygen—

The Witness: Pb plus O.

Mr. Clocker: — Pb plus O equals PbO, with excess of air at an elevated temperature. As the oxygen in the excess air attacks the surface of the lead balls it unites with lead are quite normal fashion to form lead oxide, Pb plus O gives PbO. In doing so it pits and rots the metallic balls, forming innumerable crevices, which often still contain the very fine yellowish colored red variety of tetragonal lead oxide. Lead balls taken out of the mill show some deep, larger crevices visible to the naked eye and often still filled with adhering lead oxide.

The Witness: We have an exhibit at this point of a lead ball cut in two, which shows how active and deep and irregular this pitting can be. It is not very bright, I am sorry, it should be brighter. See those streaks of lead oxide

running down into the ball? That is a regular ball out of the mill.

(The witness produced half of a lead ball.)

Mr. Morris: I offer that in evidence, 183.

(Half of lead ball, produced by the witness Ullmann, was marked Defendant's Exhibit number 183.)

Mr. Clocker: These crevices are formed in all directions and the finer pieces of lead eroded and breaking away by impacts in the mill still show further pitting and rotting and are a striking sight under the microscope.

When the oxygen of the air attacks the lead balls rolling in the mill, it does so molecule by molecule. If a group of comparatively few molecules is attacked it is to be expected that a group near the outer surface of the lead ball or a group at the surface of the innumerable crevices and branch crevices will be broken away, with a protection coating of PbO which, though porous, would protect for some time the group of molecules from complete annihilation by the attacking oxygen of the air. This group of molecules would be of varying sizes, and might initially have been of such small size that only a comparatively few molecules would be left in the original particle. This might well finally leave the metallic lead particle of very small size indeed, when it is recalled that a molecule of lead is so small that if all the people of the United States were put to picking a pound of lead to pieces at the rate of a molecule per second, it would take them about two million times as long as the period of time from the discovery of

America to the present time. If the original particle of metallic lead broken off with some protective coating of PbO were not large enough to withstand the attack of the air and still keep some of its original lead, it would of course entirely disappear as lead and be present as lead oxide.

Fineness by Attrition and Smudging.

Lead is a ductile metal and when a metallic lead surface is rubbed ever so gently over a bit of soft suede leather or a bit of paper very fine particles of lead are smudged off as can readily be seen under the microscope and these are of very small dimension, some of them requiring magnification of a thousand diameters in the microscope to make them visible.

The simple, homely reproducible experiment of rubbing the finger over a fresh leaden surface and carrying off a smudge of any degree of fineness is well-known. We have performed experiments showing the smudging of fine lead over a white paint pigment like Titanox. In the same way the fine particles of lead would leave an admixture of finer metallic lead smudge in the PbO produced in the E. S. B. gray oxide process. These very fine blue black particles of lead intimately mixed with the very fine particles of yellowish PbO would produce the well-known olive green gray shade of E. S. B. gray oxide. A well-known method in X-ray analysis is to grind a ductile substance like lead with flour to dilute it and attain finer particle size.

Much of this very fine lead rubbed off on the PbO present would be oxidized to PbO and

added to the total amount of PbO, but a portion of the very fine particles which still contain many millions of molecules of metallic lead and are not initially of single atomic or molecular dimension, would survive and appear in the product.

It is thus apparent that the varying degrees of fineness of metallic lead as found in E. S. B. gray oxide follow in harmonious steps quite logically in accord with recognized principles of chemistry, namely: Oxidation of lead with pitting, Pb plus O gives PbO;

Reduction of size of particles to smaller particles by continued surface oxidation, Pb plus O gives PbO;

Diminution of particle size by smuding the very fine particles of PbO present.

THE WITNESS: That means by smudging against the very fine particles; it means rub off.

MR. CLOCKER: The foregoing steps to account for varying fineness of metallic lead in E. S. B. gray oxide fully satisfy the mind and are based on reproducible experiment, reproducible for any amount of product great or small, and reproducible for every step in the process.

Although these steps exhaust the possibilities of process and product in the writer's experience, and opinion, it nevertheless becomes important to examine claims made by the plaintiff of steps in process and product involving the assumption, wholly gratuitous unfounded in the writer's opinion, of an intermediate substance so-called lead suboxide Pb_2O, together with claims of its activity in an assumed reversible

reaction, out of harmony with established concepts of chemistry.

THE WITNESS: Do we want to discuss the reversible reaction, Pb_2O equals Pb plus PbO? There is no need of writing that on—

THE COURT: Whatever you think.

MR. MORRIS: You may proceed, Dr. Ullmann.

MR. CLOCKER: The reversible reaction, Pb_2O, that gives Pb plus PbO, and reversed upon itself. The plaintiffs so-called "harmony" is based on the reversibility of this reaction on the supposition that an equilibrium can exist like Pb_2O which gives Pb plus PbO, and the reverse. The equilibrium is impossible. If the compound Pb_2O is assumed it might be imagined to break down into Pb plus PbO. Since, however, Pb and PbO are both solids, the molecules cannot come into sufficiently close union with one another to combine chemically. If this reverse reaction Pb plus PbO giving Pb_2O cannot take place, the reaction Pb_2O giving Pb plus PbO, in reverse, can proceed in but one direction, and that is Pb_2O giving Pb plus PbO, the reaction becomes monomolecular and all discussion of harmonies based on the equilibrium due to reversibility of reaction falls to the ground.

MR. WHITCOMB: If Your Honor please, we did not claim there was any reversibility whatsoever.

MR. MORRIS: With that concession, which I confess that I thought they had contended just the contrary, you may leave anything else that

you might have had in mind to say with regard to reversibility wholly unsaid.

By Mr. Morris:

Q. Will you pass to the next point, please, Dr. Ullmann? Don't deal any further with the reversibility in any way.

Mr. Clocker: Lead suboxide Pb_2O under the periodic law.

A compound Pb_2O is impossible under the periodic system and periodic law of the elements, and one of the best established laws of chemistry, and Pb under the system and law, and in the experience of chemists has a valence of 2 and 4, never of 1, lead suboxide, Pb_2O, would assume that lead has a valence of 1, all the tenets of the periodic law are against a valence of 1 for lead, hence lead cannot exist as Pb_2O.

Modern theory of electrons is also in agreement with the periodic system assigning a valence never less than 2 to lead.

So-called lead suboxide (Pb_2O) and its reaction with acetic acid.

The plaintiffs' testimony contains an equation in which Pb_2O reacts with acetic acid to form lead diacetate $Pb(C_2H_3O_2)_2$. The equation does not equate or balance. It will not balance—

The Witness: I would like to say here that is undoubtedly an oversight on the part of Dr. Clark, but when any court refers back to that equation he will have to recognize that it does not balance.

The Court: That is the one he wanted to insert one oxygen in.

THE WITNESS: Yes, sir.

MR. MORRIS: You are speaking now of Defendant's Exhibit 1.

THE COURT: Yes, he agreed to that. Everybody agrees to that.

MR. MORRIS: Very well.

By MR. MORRIS:

Q. It is Defendant's Exhibit 1 that you are referring to?

A. Yes, sir, I imagine so—yes.

MR. CLOCKER: It will not balance written for a reaction of Pb_2O with acetic acid, and will only balance if written for a reaction with acetic acid and oxygen. Under all laws of chemistry the equation with acetic acid must be written to form mono acetate. $Pb(C_2H_3O_2)_1$ Pb_2O plus $2HC_2H_3O_2)$ gives $2Pb(C_2H_3O_2)_1$ plus H_2O $Pb(C_2H_3O_2)_1$ is unknown, admittedly so by the plaintiff, and hence Pb_2O must be classed as unknown.

The corresponding suboxides Cu_2O and Ag_2O, both having cuprite lattice structure are known, and the corresponding mono acetate shou'd be known as they as they should be known in the case of Pb_2O. The copper and silver mono acetate are indeed well-known chemical individuals, reproducible by anyone, and react forming a mono acetate just as Pb_2O would if it could exist.

Cu_2O plus $2HC_2H_3U_2$ gives $2Cu(C_2H_3O_2)_1$ plus H_2O.

Ag_2O plus $2HC_2H_3O_2$ gives $2Ag(C_2H_3O_2)_1$ H_2O.

Pb_2O if it exists must be reproducible by other chemists skilled in the art.

It is a principle of all branches of modern science that experiments by humans to be accepted must be reproducible. All efforts have failed by the writer and his colleagues to reproduce Pb_2O in thirty per cent. concentration or in any concentration by heating lead oxalate at three hundred and ten degrees during four hours—

THE WITNESS: I am just trying to save time and cut out whatever—

MR. CLOCKER: Discovery of a supposedly new chemical individual must be established beyond reasonable doubt.

A new chemical individual before being received into the family of chemical products must have its identity established beyond a gratuitous assumption.

To recapitulate, the equilibrium with the reversible reaction Pb_2O giving Pb plus PbO, and the reverse, and the plaintiffs' inference from it are not in harmony—

MR. MORRIS: No, that comes out. I don't want any more about reversible reaction.

THE WITNESS: I beg your pardon.

MR. WHITCOMB: We say that the lead goes to lead suboxide and then to oxide, and that the lead suboxide once formed dissociates, so I don't want to confuse it, we have not said that that is not but I thought he meant after dissociation it is reversed and then goes back again. I was just trying to save the record.

THE WITNESS: I thought you said it was an equilibrium.

MR. MORRIS: I don't know where the plaintiff does stand.

THE WITNESS: I beg your pardon, if I may break in, sir, Pb_2O was in equilibrium with Pb and PbO—

MR. MORRIS: They have said they do not contend there is any reversible reaction.

THE WITNESS: All right.

MR. MORRIS: That ends it for us.

THE WITNESS: Point number one then, we will change these.

MR. CLOCKER: Pb_2O is in conflict with the periodic law.

Pb_2O is in conflict with the action with acetic acid.

Pb_2O is in conflict with the law of science that an accepted experiment must be reproducible.

Pb_2O to be accepted as a chemical individual must be established chemically and physically beyond a reasonable doubt.

On the other hand, all the established facts and reproducible experiments are fully and satisfactorily explained under accepted facts and principles of chemistry if the chemical action in the mill is Pb plus O, giving PbO, and any residual lead thus unacted on remains as metallic lead of varying degrees of fineness. This view is in complete harmony with all and every experiment that the writer and his colleagues

could conjure up as having a bearing on the composition and character of E. S. B. gray oxide.

These experiments give results easily reproducible for the additive character of Pb and PbO in E. S. B. gray oxide and fully and squarely meet—

MR. YAMAOKA: If Your Honor please, we object to this. This is rather an argument, rather than testimony.

THE COURT: Well, I know, but I have permitted that.

THE WITNESS: We will omit that. I thought it was simply an opinion. I should like, then, to recapitulate the various headings, and then subside.

MR. CLOCKER:

1. Color.
2. Specific gravity.
3. Mechanical separation of constituents, also sieving and floating.
4. Amalgamation of metallic lead.
5. Microscopic observation and microphotographs.
6. Coagulation of spongy lead.
7. Solubility of PbO in sugar solution.
8. Ignitibility.
9. Reactivity.
10. Heat of reaction.
11. Reducibility with CO, H_2, oxidation of Pb.

THE WITNESS: We have gone a little further into the matter about reproducibility, and heated lead oxalate at 310 degrees for two hours in a vacuum. We have then examined the product re-

maining. We find that this product contains 38.3 to 38.8 per cent. of undecomposed lead oxalate.

By Mr. Morris:

Q. That is after the treatment for two hours?
A. For two hours.
Q. At 310 degrees, under a vacuum?
A. At 310 degrees, under a vacuum.

Dr. Clark: C. or F?

The Witness: C., of course.

By Mr. Morris:

Q. Centigrade?
A. That is three hundred centigrade. This product was examined by X-ray experts, with X-ray expert Professor Anderson, and was found to contain besides lines for Pb and PbO the lines recorded by Dr. Clark and by him described as lines for so-called—

Mr. Whitcomb: I think we ought to object to this, again, Your Honor. We ought to draw some line.

By Mr. Morris:

Q. Do you mean, now, that that is what Dr. Anderson testified to in this case?
A. Yes, sir.
Q. And you are referring only to the testimony as given by Dr. Anderson.
A. Yes, sir.
Q. All right.
A. Dr. Anderson said—
Q. Well, what I want—
A. I see.

Q. — to have in mind, Dr. Ullman,—

A. Yes, sir.

Q. — if you will, please, sir, is to confine your testimony to a reference to the testimony as given by Dr. Anderson with respect to that matter.

A. I thought that had been covered by Professor Anderson.

Q. I think it has, but just in order that we may understand you, I simply wanted to know whether you were merely making a reference to Dr. Anderson's testimony with respect to that, for the purpose of identifying his testimony with the sample about which you are now testifying.

A. Oh, yes, sir.

Q. All right.

A. That is all.

Q. You may proceed, Doctor.

A. The residue left after heating for two hours at 310 degrees centigrade under vacuum, of course, contained other substances, lead, and lead oxide. The lead and lead oxide were removed from the oxalate and the lead oxalate further identified as such. The lead oxalate was identified by two tests. Part of it was heated in the air and turned red, as would be expected from lead oxalate.

Another portion was heated in a vacuum and turned black, as would be expected from lead oxalate. The portion which had turned black was then taken out, and on further heating in the air turned the well-known color yellowish-red, which is the result of heating lead oxalate in the air.

Furthermore, this lead oxalate would be insoluble in acetic acid, I think as I have indicated, and lead oxide might be dissolved away from it. The lead, of course, could be driven away very

easily, because it is fine lead, in this case by simply running a stream of oxygen over it at ordinary temperature, in the presence of a little moisture.

In order to further identify the original lead oxalate it was heated for a greater length of time until we got a hard vacuum—I will explain that in a moment—until we got a hard vacuum, and was then found to consist wholly of lead and lead oxide.

The method by which we determined the decomposition of the lead oxalate was as follows. The lead oxalate was subjected to vacuum, and as long as gas was given off the decomposition had not been completed. We determined whether or not gas was being given off by a high frequency current by the instrument ordinarily called a leak finder, which will tell whether there is any gas in an evacuated tube still being given off.

Now, if I may give an opinion as to the bearing of that on E. S. B. gray oxide I would say that what has been done is to take the lines which in my opinion were wholly the lines of lead oxalate and lead oxide, and because lines like them were found in E. S. B. gray oxide, to say that the lines of lead oxalate prove that E. S. B. gray oxide contained lead suboxide.

By Mr. Morris:

Q. You mean that is your conclusion?

A. Yes, sir.

Q. I don't understand you, Dr. Ullmann.

The Court: He thinks that is what Dr. Clark did.

Mr. Morris: That is what I assumed he meant, but I didn't think the record was clear on it.

THE COURT: Oh, I think it is.

MR. MORRIS: Very well.

By THE COURT:

Q. You think that is Dr. Clark's error?
A. Yes, sir.
Q. Yes.
A. It must have been.

By MR. MORRIS:

Q. You may proceed, Doctor.

A. In other words, Your Honor, I conclude it was wholly a non sequitur.

The question by you, sir?

Q. I have no question, unless you are through.

A. Yes, sir, I am through.

Q. What have you to say about the Toronto product? You have mentioned the defendant's gray oxide. Have you anything to say with respect to Dr. Wilson's sample of the Toronto product, how it compares, whether you made any examination of that, what it contained, and how it resembled and how it differed from the E. S. B. gray oxide, as briefly as you care to make it.

A. Well, we made examinations of that product, of course, for density, not to the final method that we had for amalgamation, but previous methods of amalgamation; a microscopic examination was made, to which Dr. Ewing has testified; made examinations of results of sugar treatment, sugar solution, official samples. Of course, we tried ignitibility, as everyone does. We made tests of reactivity by exposing the sample to air. We made tests of —we made tests of heat of reaction, I remember. I didn't put them down here.

Q. Did you find any Pb_2O in it?

A. No, sir.

Q. Will you summarize briefly the differences between the E. S. B. gray oxide and the Toronto product, official samples as taken by Dr. Wilson on January 11, 1935, first as to color?

A. The color was darker.

Q. Darker?

A. Yes, sir.

Q. What does that mean, if anything, Dr. Ullmann, with respect to the physical distribution of the ingredients of the two oxides?

A. It would indicate there was a preponderance of the color of the lead. The lead was probably on the outside in that case.

Q. In the Toronto product?

A. Yes.

Q. Well, in the gray oxide, the E. S. B. product, what would the gray-olive, or olive-gray color indicate to you with respect to the respective distribution of the oxide and the lead in that product?

A. The olive-gray color would indicate that the yellowish PbO lead oxide was outside.

Q. On the outside of the particles?

A. Yes, sir.

Q. What was the percentage of lead in the Toronto product, if you have it?

A. Toronto product, if you want the names of them—percentage of lead was 27.7; another one of the samples, 27.6; another one, 28.2 lead; another one, drum sample, 26.3 lead.

Q. And what did you find the remaining portion of that Toronto product to be?

A. PbO.

Q. I don't recall whether I have asked you in the

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last two minutes whether you found any Pb_2O in it or not.

A. We found no Pb_2O in it.

Q. You found no Pb_2O in it. What difference, if any, did the physical distribution of the two ingredients make in the reactivity of the Toronto product compared with the gray oxide manufactured by the defendant at Philadelphia?

A. The Toronto product would be expected to be more reactive, as it is.

Q. Because the unconsumed lead is more exposed?

A. Yes, sir.

MR. MORRIS: All right, you may cross-examine.

By MR. MORRIS:

Q. Oh, will you take out for me, please, your sheets with regard to heat of reaction?

A. I have a chance to go over them and correct them?

Q. Well, won't you do that, then?

A. I mean, they are nearly correct, anyway.

THE COURT: I have to make a phone call some time this afternoon. I guess this is as good a time to do it as any. Suppose we recess.

(Recess at 3.15 o'clock P. M.)

HARRY M. ULLMANN, recalled.

MR. MORRIS: I offer in evidence, as the Defendant's Exhibit 184, Dr. Ullmann's heat of re-

action testimony and experiments—there are a number of them—pages 71 to 85, inclusive.

THE WITNESS: Judge, may I make a statement about the testimony? That can't go in an exhibit because there's a lot of that stuff, conversely, in there and it's not in my testimony. If you don't mind, I will edit it a bit.

MR. MORRIS: All right. I will withdraw the offer.

MR. WHITCOMB: Well, we wanted that in; that's what he was reading from, wasn't it?

MR. MORRIS: No.

(Discussion off the record.)

MR. WHITCOMB: All right, sir.

Cross-examination.

By MR. WHITCOMB:

Q. As I understand it, you made some amalgamation tests with mercury—

A. Right.

Q. —and that brought down the lead and the residue. Did you save the residue?

A. Yes, sir. The residue came out. It's the only little step I omitted, and if you would like to know exactly that little step: In order to separate mercury from the oxide, another material, we did the customary thing, and that is we filtered it, and the effective method of doing that is not the usual method but one employing the thicknesses of cheesecloth. It is filtered through the cheesecloth, you know, and the mercury squeezed out, which brings the other materials not amalgamated on the cloth.

Q. Did that leave the lead oxide?

A. Yes, sir.

Q. What did you do with that?

A. Why, we proceeded—it was soluble, that is, the black material itself was soluble in acetic acid.

Q. Well, the black material—is lead oxide black?

A. Oh, it was—whenever you mix any materials with mercury and shake them, the very small globules of mercury distribute in the material and it gets a dark color, like that. There's some of the mercury in lead distributed in there.

Q. Just a minute, maybe you didn't understand what I mean. You started with a sample of Exide oxide—

A. Yes, sir.

Q. —and you amalgamated it with mercury?

THE COURT: I will answer for him. He just nodded his head.

By MR. WHITCOMB:

Q. Yes. And the mercury took up the lead?

THE COURT: Yes.

By MR. WHITCOMB:

Q. Did you retain all the rest of the sample from the gray oxide mill that you used in that particular experiment with the mercury?

A. No, sir, we didn't retain all of that because it is usually spread on the cheesecloth and stuck to it.

Q. Then you don't know what percentage—what the percentage of oxide was? You only got the lead out by that process?

A. Yes, sir, that is right.

Q. Then, so far as there being any lead suboxide, you don't know what happened to the oxide end of it?

You only know you got so much lead out of it? That's right, isn't it?

A. Yes, sir.

Q. Then you made an acetic acid test, did you not?

A. That wasn't a test. We simply dissolved it in the acetic acid, which—

Q. Now, that was another sample entirely? You took another sample of the Exide material and ran the acetic acid test?

A. Not in connection with this, no, sir.

Q. You didn't make any acetic acid test?

A. Not in connection with this. In connection with this, we made many acetic acid tests, you also do that when you analyze. In this connection, in order to make doubly sure, we didn't determine the lead by difference—determine the lead in the original—

By The Court:

Q. Naturally, actually weighing the lead sulphate from it?

A. Yes.

By Mr. Whitcomb:

Q. At no time, as I understand your testimony, then, have you attempted to figure the percentage by a chemical method—of the PbO, for example—that may be in the Exide mill?

A. Oh, yes; many times.

Q. Well, how did you do that?

A. Why, we dissolved the PbO in acetic acid.

Q. Where did you get the PbO?

A. PbO—out of the E. S. B.—oh, we took the whole sample.

Q. And that had some lead in it?

A. Yes, sir.

Q. And then what did you do?

A. Treated that with acetic acid.

Q. And then, if acetic acid dissolves Pb_2O, then you dissolved that, too. Is that right?

A. If acetic acid dissolved Pb_2O, and if there was no Pb_2O present, I don't know whether it would or not.

Q. But your tests didn't distinguish whether there was PbO or Pb_2O in the mixture, did they?

A. You mean, the tests with the acetic acid?

Q. Yes.

A. It depends on what the properties of Pb_2O are.

Q. Assuming that they are both soluble?

A. Yes, sir. If they are both soluble by acid—acetic acid, I mean—

Q. Do you know—

THE COURT: Let him finish.

THE WITNESS: If they both dissolve by acetic acid, they were both completely dissolved.

By MR. WHITCOMB:

Q. You had no way of determining how much of each was in the substance?

A. If you assume the lead suboxide was completely dissolved by the acetic acid—

Q. Let's assume—

A. —if present, it was completely dissolved by the acetic acid. The lead oxide was also completely dissolved by the acetic acid. I could still determine how much Pb_2O, if you please, and how much lead was present.

Q. Did you do so?

A. No, sir.

Q. Will you do so?

A. No, sir; I can't. I haven't anything to do it with.

MR. WHITCOMB: Of course, your Honor, we contend that he hasn't proven anything about the capacity to determine, just like he started out with—that there is no chemical way of determining, in a mixture of, say, lead suboxide, if it exists, mixed lead—a mixture of lead suboxide and PbO. The record has not shown any method whatever of determining whether the Pb_2O exists chemically.

By MR. WHITCOMB:

Q. Can you explain whether or not you have shown any way?

A. Yes, sir; I can show you a way.

Q. Well, have you, on your direct testimony?

A. No, sir. I have simply said it could be done—the Judge asked me. I think the Judge asked me, and I said it could be done.

Q. Well, please explain how it could be done then?

A. Well, if your Honor would like to understand it, I am afraid I will have to have a blackboard.

THE COURT: All right.

MR. MORRIS: We will have this one.

(Discussion off the record.)

THE COURT: Well, is it really more for Dr. Wilson than anybody else, so you had better come around where you can see that blackboard.

By THE COURT:

Q. Now, what we have in mind, if I have the same

thing that Mr. Whitcomb has, is that you are given a sample, which you are told comes from the Exide plant, and which you are also to d the people who give it to you think it consists of lead and lead oxide, and the first thing you do is you can remove all the lead from that sample. Just go back a minute—you take that sample and, possibly, you divide it into more than one part—wait, you had better follow my question. The first thing you do is to divide that sample, we will say, into two or three parts, assuming that it is uniform; then you take one part and, by your amalgam process, you remove all the lead. That's right, isn't it? That's what you do?

A. That can be done, yes, sir.

Q. That's what you did?

A. Yes, sir.

Q. From—all the metallic lead—

A. Yes.

Q. —you removed that by amalgam?

A. Yes.

Q. We will call that portion one of the sample. The balance of portion one you just throw away—you let it go?

A. We had no method—

Q. The fact is,—I'm not asking for an explanation—I want to really start with facts, then we can build it up. The fact was, the balance of portion one you just threw away, you didn't bother with it any more?

A. Yes.

Q. Then you took sample two and, as I understand it, by means of acetic acid tests, or acetic acid process, you dissolved everything in that sample that was not free metallic lead. Is that right?

A. Yes.

Q. And everything in that sample did dissolve except the free metallic lead. That's right, isn't it?

A. Yes, sir.

Q. So that you got from sample number two, you got free lead and you got a solution of something?

A. Yes, sir.

Q. Now, the percentage of free lead, metallic lead, in sample number two, as I understand it, corresponded exactly with the lead that you had removed from portion number one by amalgam?

A. Yes.

Q. You still had your solution that came from portion number two?

A. Yes.

Q. Now, what I would like to know is whether you made any further analysis of that solution to see what it contained?

A. I made no further analysis. We did, in order to check it, make a gravometrical determination of the total lead it contained.

Q. You did that much?

A. Yes, sir.

Q. So that you came to the conclusion that the solution derived from what I am calling portion number two contained lead and something else?

A. Yes, sir.

MR. WHITCOMB: Can I ask him one question?

THE COURT: All right.

MR. WHITCOMB: I was wondering if, in that further test of that solution, he had left over after number one, did he get any more lead?

THE COURT: Now, wait. You are off the track—

MR. WHITCOMB: All right.

THE COURT: —that is, you are off my track. It may not be the right one.

MR. WHITCOMB: All right.

By THE COURT:

Q. In the solution which came from portion number two, you did find lead. Is that right?

A. No, sir. I didn't find any free metallic lead.

Q. No?

A. I determine the lead by analytical methods.

Q. You found lead—any combination of—I don't know how you express it—

A. In the solution, yes, sir.

Q. —you found lead and you determined the amount of that?

A. Yes, sir.

Q. And that didn't tell you anything further. As I understand it, all that told you was that that solution was one of the oxides of lead, or did it tell you more than that?

A. Well, the solution, if you speak exactly, told me it was the second lead present, combined with at least—it went into the solution after treatment with the acetic acid, yes, sir.

Q. Now, did you get any further information about that portion of what I have called portion number two that was in solution?

A. Did I actually get any? No, I did not. But you asked me whether there was a method by which it could be obtained.

Q. I did ask you that, yes.

A. And I told you that there is.

MR. MORRIS: On two assumptions—one that PbO exists and that it will dissolve in acetic acid?

THE WITNESS: Of course. That is understood.

By THE COURT:

Q. Will you go back again? Suppose the sample that had been given you by the Exide people, unknown to yourself and to them and everybody else, contained, let's say, lead and lead oxide and red lead. It could do that in a mixture, couldn't it?

A. I imagine it could.

Q. That's not impossible?

A. Yes.

Q. Could you detect that? Yes. Did the things that you actually did—were they sufficient to show you, for instance, that there was no red lead present in that process?

MR. MORRIS: Your Honor means Pb_3O_4 and not red litharge, I assume?

THE COURT: I am trying to pick out some other oxide of lead.

MR. MORRIS: Red lead is sometimes known as—

THE COURT: Red tetragonal, yes. But, I mean some other.

THE WITNESS: Well, that introduces another complication, if you please.

THE COURT: All right, I am afraid it does. Go ahead.

THE WITNESS: That introduces another complication with the extra atom of oxygen there, which would—

By THE COURT:

Q. But, the point is this: Did you do anything that would show that there was not, for instance, red lead present in that solution? Would red lead have been dissolved the same as PbO?

A. I think so, yes, sir.

Q. Well, then, I want to just find out the extent and the value to me of what you did.

A. Yes.

Q. Then, as far as you know, you couldn't testify, for instance, today that there was no red lead in that mixture, could you?

A. No, sir.

Q. Well, then, how can you testify that there is no PbO?

MR. WHITCOMB: Pb_2O.

THE WITNESS: Pb_2O.

By THE COURT:

Q. Yes, Pb_2O—assuming that there is such a thing. It's only one of the other oxides of lead, isn't it?

A. Yes, sir. That is a rather peculiar thing, your Honor. In all our experiments, the lead and the lead oxide—determined by various chemical and physical tests—added up to a hundred, as near as you can or as near as can be determined by humans—and that left no room, as far as I am concerned—

Q. Now, wait. That, I understood to be your general procedure?

A. Yes.

Q. Surely. And then, when I come to inquire—I don't know what test you made to show what amount of lead oxide was in the sample.

A. I think I can clear it up, if I say one more thing.

Q. Yes.

A. As we went along, our results—the results we got appealed so much to us as rational persons and rational chemists—were so indicative that our gray E. S. B. oxide was made of lead and lead oxide, that we went no further in our assumption—our examination. And, not until this case came up yesterday, until that matter came up yesterday, did I try to think out a method by which it could be done. And, last night, having a few moments, I wish to say this quite frankly, I thought, "Why you better find some method by which it could be done if that were possible," and I thought out a method, and I am sure it is right, but I have not had time, since last night, to carry it out.

Q. All right. Well, now, that's within the result, as I understand it—the result of your testimony—and I want to be sure about this: It is solely to the effect, and goes no further, that there was—I didn't mean the result of your testimony, strike that out. The result of your experiments couldn't show there was—couldn't show any more than there was a mixture containing lead and some oxide or oxides of lead?

A. It went further than that, if you please. The physical determinations, and they are very exact, the physical determinations of density and heat reaction accorded exactly, right to the dot, with PbO, known and—

Q. And with nothing else?

A. And with nothing else, unless the PbO should happen to have exactly the same properties as Pb, which is, in the mind of a rational chemist—

Q. That's perfectly clear to me. We start, then, with the proposition that the amalgam experiment alone did not tell you that?

A. The amalgam experiment alone didn't tell me that, but the lead accorded exactly.

Q. That's what I want to know. To get the exact amount, the other fraction of your mixture showed that that accorded exactly with the Pb or the supposed PbO contained. Then you resorted to density and—what do you call it?

A. Heat of reaction.

Q. Yes, heat of reaction.

THE COURT: All right, now. Mr. Whitcomb.

By MR. WHITCOMB:

Q. Now, in connection with the heat of reaction tests, Dr. Ullmann,—

A. Yes, sir.

Q. —you are acquainted with this German journal, "Kolloid-Zeitschrift"?

A. Yes, sir.

Q. That's a recognized standard?

A. It is a regular standard journal, yes, sir.

Q. Now, in the 1934 issue, on page 318, is this paragraph here (indicating), which we have translated to read as follows:

MR. MORRIS: Will you be good enough to compare the German with the translation submitted, Dr. Ullmann?

THE WITNESS: Yes.

MR. WHITCOMB: (Reading) "The energy content of the oxides is higher the lower the temperature and the greater the speed at which it is formed. The forms with richest energy content have molecular heats of solution which are, for example, for zinc oxide 1300, beryllium oxide

1400, magnesium oxide 2500, and iron oxide Fe_2O_3 more than 5000 calories greater than the values for oxides with minimum values. It is thus easily shown that the energy-rich oxides possess enhanced catalytic power and chemical activity."

By Mr. Whitcomb:

Q. And I ask you to state if that does not mean that these oxides vary from a minimum to an excess of 5000 calories, in some instances?

A. Yes. Kilogram calories are thousands of calories, and this makes the statement that they vary from 13 calories to 5 kilogram calories for sumstances made up, of course, wholly of some kind of oxide. I haven't got that yet. Are those colloidial articles? I would have to red—I mean, read the whole article.

Q. Yes, but that particular paragraph, translated as I read it, about being subject to variations—

A. Now, wait. I haven't read this article. It is a very long article, sir. I would have to read it and see what the significance of that is.

The Court: Can you show me where, on the Doctor's notes, the density test is referred to? I dont' want to put his voice to the strain of going all over it again.

The Witness: Yes, sir. About X-ray analysis—I beg your pardon.

Mr. Morris: I assume that's it, although my notes aren't the same as his.

(Discussion off the record.)

By Mr. Whitcomb:

Q. Have you ever read this article?

A. No, sir, I have never read this article. I will have to go over it sometime.

Q. But its true that some oxides have a variation in the heat energy content, isn't it?

A. I don't really know whether—it's very important to read that article, as applying in this case, your Honor, because this Friche, who wrote this article, is exactly the same man who said that Pb_2O should now be stricken from the literature.

Q. Well, but oxides do have—you are talking about a heat test, now, however?

A. But I can't talk about it without considering Mr. Friche's article, because he tells me, before I start, that there is no lead suboxide and, if I am to believe him in one place, I am to put just as much reliance in his as in the other.

Q. I am asking you if you really think there is—

A. I say, I don't know, sir. I will have to read the article.

Q. I mean, of your own knowledge?

A. No.

Q. You don't know?

A. No, I don't know.

Q. If such a matter of five per cent of suboxide in the contents of the material that you subjected to a heat test, assuming that it was, then your heat test wouldn't bring out that differentiation, if it was a matter of five per cent?

A. I don't know whether it would or not. There's nothing said here about the oxide of lead to which you are referring—and this man, Friche, has undoubtedly had a great deal of it. He must have had some of it in the laboratory, but this makes no reference to Pb_2O.

Q. In this Exhibit 180, offered, where did you get the lead at the top?

A. That particular sample of lead is the fine lead

and is the purest one I could get. I got it given to me, very kindly, by Mr. Hall—but I have done exactly the same thing by lead obtained from Eimer and Amend.

Q. I understood that this came from the oxide samples that were handed to you?

A. No, sir. That's a synthetic mixture to start, with pure lead and the very purest kind of tetragonal lead.

Q. Yes.

A. And you get exactly the color you wou'd expect if it were a nice chemical mixture.

MR. MORRIS: Will you read me the exhibit on the bottom of the box about which you are now speaking?

MR. WHITCOMB: I just did. It's Exhibit 180.

MR. MORRIS: All right.

By MR. WHITCOMB:

Q. Do you think there is free lead that fine in the Exide oxide?

A. I really don't know how fine that lead is. I have never examined it for fineness.

By THE COURT:

Q. Does this density test come down to determine the average density, if you may call it so, of the whole mixture?

A. Yes, sir, the average, with the added density.

Q. The average, with the added density, yes. And, knowing the densities of each component, you then figure, if you get an added density, that's the exact average of the two. You must have those two?

A. You must have those two.

Q. That's about the test, isn't it?

A. Yes, sir. It's like all these other things that we have in science, sir. When everything, chemical and physical, that you can think of points in one direction, why you are forced to that conclusion.

Q. I am wondering about this test. Now, I just—suppose you have two substances; the density of one I don't know—I don't know anything about those units—but the density of one is twenty and the other is ten units, or whatever it may be. You get an average density of the whole thing of fifteen, don't you?

A. If you mixed them in equal proportions, yes.

Q. Yes, if you mixed them equally, in equal proportions?

A. Yes.

Q. Now, you couldn't get that any other way. You couldn't get that any other way. If one of those substances—lead was in it—and, say, that's twenty. You must have the other substance which has a density of ten to make your average?

A. Yes, sir.

Q. Well, suppose that other portion instead of one with a density of ten should consist of two things—

A. Yes. Well, I—

Q. —one with a density of fifteen and the other with a density of five—

A. Mixed in equal proportions?

Q. —mixed in equal proportions, yes—

A. Yes, sir; that would be all right.

Q. Then, you would still get an average density of fifteen for the whole thing, wouldn't you?

A. Those figures are exactly right.

Q. They are not exactly right. I am trying to get them exactly right.

A. If you had an average density of ten, you would.

Q. Yes. If you got an average density of ten out of your part that wasn't lead, you would get the same added density, you call it?

A. Yes, sir; you would.

Q. So that it might consist of three substances instead of two, your total mixture?

A. Yes, it might.

Q. Your density test does not prove that?

A. Hypothetically, it might, of course.

Q. Yes.

MR. WHITCOMB: Dr. Ullmann, —oh, I beg your pardon.

By THE COURT:

Q. Did you say—then, am I understanding—am I to understand that no single one of the experiments that you subjected this mixture was, in itself, conclusive, or is that correct? Am I correct in saying that—that you relied upon the coincidences of all the experiments?

A. I should say it was conclusive. For example, I should say that the heat of reaction, as we go along this whole thing, is conclusive, unless you make assumptions about another compound.

Q. I am taking density now. That test, alone, would you say was conclusive?

A. No, sir. It is merely very highly presumptive.

Q. And cumulative?

A. Yes, sir.

Q. And the heat of reaction test, standing alone, you say it is conclusive?

A. The heat of reaction test? Why, you can make suppositions about that, as you did about the other—that you might have two substances, one on either side. You can do that, of course, with any quantitative result.

Q. I can see, with your density test, that it would be an absolutely conclusive assumption with only two substances in the compound?

A. The chances are, in your heat of reaction test agreeing with the results. I mean, supposing you had three substances in your density test. I don't know what the probabilities are, but I guess it's much less than one in a million.

Q. I know that's the way scientific tests are arrived at.

A. Yes, sir; that is right.

Q. I realize that by the use of various tests, no one of which is conclusive, and you get a coincidence that is so remote to occur by chance—that is too remote to occur by chance—that you come to the conclusion that the fact has been established.

A. Yes.

Q. I realize that, I say.

A. It can be. The chance, if you get a perfect agreement by one method and a perfect agreement with the other, for three substances, the chances are almost like the chance quoted by—well, I won't bring that in—but it was by one of our fine philosophers.

Q. About the chance of the Titanic hitting the iceberg, but they did it.

A. As long as you bring that up, sir—

Q. I think somebody calculated that was about one in three or four billion, I have forgotten how many.

A. —that philosopher said: "That the successive jabberings of successive monkeys going up the Congo might simulate Dante's Divine Comedy."

Q. Well, I know what you are talking about anyway.

MR. WHITCOMB: There's one question I want to ask Dr. Ullmann.

THE COURT: All right.

By MR. WHITCOMB:

Q. Do you understand that Le Blanc has shown that there is a substance, PbO sub one point one two?

A. Yes, sir.

Q. And, in that case, do your tests differentiate here a substance containing that compound over PbO, say, or a mixture of PbO with suboxide?

A. To that I would have to respond that, in the same journal which gives us that knowledge, a little later in the journal Mr. Le Blanc makes this statement about lead suboxide—he took the same oxalate oxide and heated it, and he says—I will translate it:

> "The solid residue consists of finely divided metallic lead and red oxide of lead. The determination was carried out by microscopic and X-ray methods. Indications of any suboxide Pb_2O could not be found."

That's the same, as a matter of fact, sir.

Q. But, I am asking about PbO sub one point one two, leaving out the suboxide.

A. I must retort to that, sir, that that would have no relation to lead suboxide.

Q. I'm not saying it does.

A. I beg your pardon, sir, because that's the same man, who—whom am I to believe. See? If I believe him there, I must also believe him here. And it does not apply to lead suboxide because he says the lead suboxide could not exist.

Q. I am asking you how that would affect your tests if the substance actually had PbO sub point one

two, instead of PbO—your density tests, your heat of reaction tests?

A. I can't permit myself, sir, to logically reply to that, because that would not be a chemical individual. When it becomes a chemical individual, it should have the composition—the lowest composition it could have would be PbO—and what I mean by chemical individual is the kind of thing according to which we buy and sell any patent.

MR. WHITCOMB: Well, of course, that doesn't answer the question. I wish—shall I press it further?

THE COURT: As you like. You see, I have lost—this heat of reaction test is the one—maybe I can find out something about it—but that's the one I didn't think it was necessary for me to understand because he says it's on the same footing.

MR. WHITCOMB: The same footing as the other?

THE COURT: Yes.

MR. WHITCOMB: But we are trying to take it and speak further, your Honor, to show that if he had a substance recognized as PbO—

THE COURT: Hasn't he already said all you want? That is to say, that the heat of reaction test is the same basis as the density test, and that there might be—that the balance, after you take the lead out—that the balance might be two substances?

MR. WHITCOMB: Yes.

THE COURT: And a compound of two sub-

stances which would give him the same result as the lead oxide.

MR. WHITCOMB: Cross-examination closed.

(Discussion off the record.)

MR. WHITCOMB: Could we ask him one more question?

THE COURT: Yes.

By MR. WHITCOMB:

Q. Did you actually conduct these tests that you have testified about yourself?

A. Well, do you mean, did I do all of them with my own hands?

Q. Yes.

A. No.

Q. Well, any of them?

A. Yes, some of them. I was in the laboratory regularly.

THE COURT: Well, I will assume that he had supervision enough over them to testify that they were his own.

By MR. WHITCOMB:

Q. Then, we wanted to ask how many grams of lead oxalate did you use in the decomposition test?

A. Why, in the decomposition test—oh, that would weigh forty grams—the amount of lead oxalate we used. I can't tell exactly, but there was about that much—that's in an Erlenmeyer flask.

(Discussion off the record.)

MR. WHITCOMB: If you don't mind, there's one more question, following that, about the amount he used.

THE COURT: All right.

By MR. WHITCOMB:

Q. If you had an exceedingly thin layer of lead oxalate and heated it in a bowl at 310 degrees C., as you testified about, is it likely that the decomposition might be complete?

A. Not in two hours.

MR. WHITCOMB: That is all.

HAROLD V. ANDERSON, recalled.

Re-direct-examination.

By THE COURT:

Q. Dr. Anderson, I don't know whether your experiments put you in a position to answer this question or not. I really intended it for Dr. Davey, but let's see if you can help us with it. The examination you made by the X-ray machine of the sample gave you lines of lead, as to which there was a very close correspondence with Dr. Clark's lines?

A. That's in the gray oxide?

Q. Yes.

A. Yes.

Q. And it also gave you the lines of tetragonal litharge?

A. That's right.

Q. Which corresponded very closely with Dr. Clark's lines?

A. And also with the so-called theoretical spacings and the analysis of red PbO.

Q. Yes. Now, as I understand it from Dr. Davey, it also gave the lines of lead carbonate?

A. There are—according to my testimony, I believe I testified that I found nothing else but lead and red PbO.

Q. Oh, you didn't find any lines of lead carbonate, then?

A. No, I didn't.

Q. Then we can't ask the question I had in mind. You remember he had an illustration that he used, about the partial fingerprint?

A. Yes.

THE COURT: Well, all right. Then, we just can't do it. We will have to just ask Dr. Davey somehow.

MR. MORRIS: Very well.

(Discussion off the record.)

MR. MORRIS: I didn't put in the Wyckoff book, to which reference was made, showing the carbonate lines. It might be that might have a tendency to help your Honor.

THE COURT: No. But I remember it, if you want to put it in. That's the one with the spider web?

MR. MORRIS: No, sir.

THE COURT: Isn't it?

MR. MORRIS: No, sir. I will show you.

MR. MORRIS: Am I going to be supplied with one or two books on this subject, if I promise to read them?

(Discussion off the record.)

MR. MORRIS: On page 274 of this edition of Wyckoff's of 1931, there is this:

MR. WHITCOMB: This is Clark's?

THE COURT: No, he's not talking about that right now. He's showing me where these lead carbonate lines show up.

MR. MORRIS: This edition, 1931, of Wyckoff's, page 274, there's this—the following: $PbCo_3$, orthorhombic. Then, under a sub zero, is the measurement of 5.14, and then, under the c sub zero, there are—under the c sub zero, or alpha, is 6.10. Now, then, that shows the basis of Dr. Davey's testimony.

THE COURT: Well, all right. I will get that from him.

MR. MORRIS: Yes, sir, but I wanted you—I just wanted you—

THE COURT: I am afraid this is a little over my head.

(Discussion off the record.)

THE COURT: All right. Go ahead with Mr. Hall, if you want to.

MR. MORRIS: Mr. Hall, will you take the stand?

CLARENCE A. HALL, was called as a witness on behalf of defendant and, having been first duly sworn, testified as follows:

Direct-examination.

By MR. MORRIS:

I am connected with the Electric Storage Battery Company, the defendant in this case, and have been so

connected since June or July of 1920. I am the same Clarence A. Hall who was in the Interference with the plaintiff in this case, Mr. Shimadzu, in the Interference Nos. 54,798 and 56,224. The testimony, purporting to have been given by me in the copy of that interference record, introduced in evidence as one of the plaintiffs' exhibits in this case, correctly reports my testimony there given, so far as I know. The product of my mill that I was dealing with in that interference, was the lower oxides. It was the lower oxidation products. In my mill we have succeeded in getting an oxidation calculated as litharge as low as twenty per cent and from there up to eighty per cent. Our commercial product is grayish—gray oxide, as shown in the samples here in evidence. The color of those low oxides that I am talking about was very dark gray, much darker than the gray oxide; much lower. In comparison, this is much darker in color than the product we are making in Toronto. I mean, it is darker than the color of our product. The Toronto product is darker than our product. The lower oxides I am talking about are darker than the Toronto product. That's right.

I am the same Clarence A. Hall who is the patentee in United States Patent to Hall, No. 1,675,358 and also in the patent to Hall, Clarence A. Hall, No. 1,888,823. I first put a cyclone on my mill or what has been referred to here as the Hardinge Mill two or three months after we started in January, 1921. Mr. Davey yesterday or the day before testified that he had received some lead balls from me and that he had made certain analyses with respect thereto. His testimony in that regard is correct. The balls were marked by drilling a large hole in them so as to identify them, and they were placed in the mill early Monday morning when the mill was cold.

MR. WHITCOMB: Does Mr. Hall say he got them from the mill?

THE COURT: Sure.

MR. WHITCOMB: That's all right, then. There's no dispute on that.

The witness, resuming, testified: I put them in at the feed end of the mill when the mill was cold on Monday morning and started operations, and when the temperature got up to 175, I stopped the mill, and there were a few balls still up there at the feed end. They were picked out with tongs and put in cans filled with nitrogen. We stuck the tongs down in the mill and put them in the can, and they were—then they were sealed up. They were identified by the hole I drilled in them before I put them in. The apparent specific gravity of the lower oxides produced by me from time to time, with respect to which I testified in Washington, was either 2 or 2¼, or something of that sort, as near as I can recall.

THE COURT: Which one—150?

MR. MORRIS: Yes, sir. Beginning at about fifty or fifty-five.

THE COURT: All right.

The witness, resuming, testified: the black powder was chemically reactive. It was spontaneously converted into litharge by exposing it to air. Many times the drum caught fire when the material was fed into it. It would sometimes catch fire. If a drop of water was dropped on a pile of my black oxide, that would start reaction. It would continue. The pile commenced to oxidize until finally the whole thing oxidized. It changed color. If you applied a lighted

match to a pile of it, it would burn, and it would continue to turn until it was all burned up. The oxidation started by the application of a match or a drop of water on the pile would continue until substantially all of it was converted into litharge. The gray oxide, as manufactured for commercial purposes by the defendant since 1924, will not burn if a lighted match is applied thereto. If a drop of water is applied to it, it would make mud. We can make black oxide with our present set-up. We can make anything we want. That was my original contention. We have made the lower oxides. The result of those interferences appears in the decision of the Court of Customs and Patent Appeals, filed June 20, 1932, and reported in 59 Federal Second 225.

MR. SCHAFFER: We object to that. The decision speaks for itself. There's no use to have this man interpret it.

MR. MORRIS: This man is identifying it.

THE COURT: There's no use spending two minutes on either the question or the objection.

MR. MORRIS: He's merely identifying it as the decision in this case, and that has been done by my question and his answer.

THE COURT: All right.

The witness, resuming, testified: The date on which the bag collector was annexed to my machine or first installed was some time in June or July, as near as I can recall, '21. Referring to Defendant's Exhibit number 47, this is the bag collector that we bought from the Sturtevant Company after I had tried to make a lot of home-made things and didn't

succeed. This was the one I eventually installed, but I must admit I made a mess of bag collectors. I had some home-made bag collectors when I started and it was the home-made one I was referring to a while ago. By "home-made" I mean made by the tin shop or in the factory of the defendant.

Cross-examination.

By Mr. Whitcomb:

I filed an affidavit in this case in connection with a motion. In that I stated:

> "Since 1921 and to the present day, the lead oxide powder manufactured by the Defendant, a commercial compound used in the—and commercially used in the manufacture of storage battery plates—has been continuously analyzed and carefully tested for its chemical and physical properties, and I have recently examined the record of these tests and analyses which are on file in the Defendant's office, and these records show, and I know it to be a fact, that the lead oxide powder manufactured by the Defendant and used in storage battery plates is the same now as it was in the beginning and has been the same throughout the entire period of manufacture. Furthermore, the process has never been changed in the manufacture of lead oxide powder for use in storage battery plates from the beginning of 1921 to the present time, and during all that time a Hardinge mill has been exclusively employed."

That's perfectly correct. That is not the powder I was talking about in the interference, it had nothing to do with it whatever. I was talking about low

oxidation products. I tried some of those, but the regular product that was being used for the manufacture of plates was what I put in that statement. It had nothing to do with this other product, this lower oxidation, in which the interference was filed. It corresponds to my testimony in the interference. The whole testimony there was based on making the low oxidation product. I never said I used that low oxidation stuff commercially. If I did, I'd like to see it. The low oxidation is made for experiments. I went all up and down the line and very quickly adopted sixty-six or sixty-eight per cent, and that was some four or five months after I started, and we have continued that as our standard product ever since. So that I can't see the record of the Interference has anything to do with the product we have been making and using in the storage batteries.

By THE COURT:

Q. What was the date of the interference?

A. I think it was—

MR. WHITCOMB: 1928 and 1929.

THE COURT: What was the date of the hearings?

MR. WHITCOMB: The taking of the testimony was in 1928 and the hearings went on into 1929.

THE COURT: Well, it is stated in the Interference proceedings that the black oxide was an experimental product and wasn't a commercial product?

MR. WHITCOMB: No. They go on and point out how they used it commercially.

THE COURT: All right.

I have stated that all the testimony I gave and, as reported in here, is what I gave at that time, and that testimony was entirely directed to the products which were in Shimadzu's patent, and I felt I was entitled to this. On page 41 of the Court of Appeals record I said: "'Well, what were your best results, do you remember that?' That was the question, and you answered, 'When we had sufficient air to blow the material out of the mill.'" You must take all of this testimony. You can't pick out one question.

Q. You said that, did you not?

A. Surely. Certainly, I said it.

Q. In that particular page, 53 XQ110 is: "How much air do you use now for nineteen thousand pounds of lead balls?" The answer: "About eight or nine hundred cubic feet." That's correct, isn't it?

A. Well, you will find a little bit later in there I said I didn't know how much air. That particular answer just says that. I think you will find later on in that particular testimony I said I really don't know and I didn't know how much.

Q. Doesn't any of the air go in with the balls now?

A. Just while the ball flap's open, and I don't think that's much.

Q. But some goes in?

A. No. I don't think there's enough to keep you alive—there's just a momentary flap in there.

By The Court:

Q. Well, now, Mr. Hall, may I—so I don't misunderstand anything—but, right in that page, it follows down there, "Have you or anyone related to you sold any of this powder?" and the answer is, "It is all consumed by the Electric Storage Battery Company,

so far as I know." Now, you are still talking about the black powder?

A. Your Honor, it was brought in there time and time again about the product that we are making, and I think Mr. Stoughton once tried to suggest we weren't talking about that product—that we were talking about the lower oxides.

Q. Now, then, on page 53, there where it says, "Have you or anyone related to you sold any of this powder?" and you said, "No, sir, it is all consumed by the Electric Storage Battery Company; so far as I know." Question, "What do you use it in?" Answer, "Use it to make plates, storage batteries, out of." Question, "You use it?" Answer, "The Electric Storage Battery Company do." Which or what powder are you talking about there?

A. That was the black powder. I made plates out of it, but they just weren't worth a whoop, and we had to throw them all out.

The witness, resuming, testified: I don't know whether during the interference I made any distinction between the higher or lower oxides in my testimony. I didn't attempt to say one was in the interference and one was not, that I recall. I thought it was perfectly understood that we were talking about the black stuff.

Q. Page 57, XQ142, "When you use the larger amount, six hundred and fifty cubic feet per minute, does that blow it all out? Answer, "It blows all the fine material out. The coarse stuff filters over just the same." Isn't that a correct statement?

A. Which question is this, now?

Q. 142, page 57.

A. Oh, all right.

Q. "When you use the larger amount, six hundred and fifty cubic feet per minute, does that blow it all out?" Answer, "It blows all the fine material

out. The coarse stuff filters over just the same." That's correct, isn't it?

A. The coarse material spills out of the Hardinge mill and, of course, any dust created by that stuff is kicking around there, when the air is blown out. Certainly, that's blown out.

The witness, resuming, testified: It is true that it blows out all the stuff that will float in the air, certainly.

Q. In this Interference record, of course, you insisted, in several instances and time and time again, you produced suboxide, did you not?

A. Well, if the Patent Office dubbed the stuff of Shimadzu's—the stuff Shimadzu made—suboxide, I thought I could use the same term. So, therefore, I called it suboxide.

Q. Well, were you pretending, then, during the Interference?

A. It wasn't pretending, any more than Shimadzu's patent was—any more than Shimadzu was pretending. He had the stuff called suboxide. I had made the same material, and I felt I was entitled to the same claims.

Q. At that time, what did you think it was?

MR. MORRIS: Are you asking from a physical standpoint or chemical?

MR. WHITCOMB: Any way the Defendant claims to have invented.

THE WITNESS: Well, are you in as much doubt about Pb_2O? So long as it was the compound under discussion, I thought it was—I thought I was perfectly justified in using that name.

By Mr. Whitcomb:

Q. Well, didn't you go further than that? Didn't you say in the interference that you started out with the idea to get suboxide?

A. I started out with the idea of getting the low oxidation material that was made in Germany, and which I had heard about, and which, for a while, they called suboxide over there.

Q. So you knew about this material before you filed your application?

A. Not the material I am making. I didn't make the same material the Germans made.

(Discussion off the record.)

By Mr. Whitcomb:

Q. On page 64, in answer to XQ183, it says: "Olive gray powder; that is, the product we were trying to get, which we did get." You testified then that it was olive gray?

A. Which question is this, now; I didn't get that?

Q. Page 64.

A. Which question?

Q. 184.

A. Yes, we got olive gray powder.

Q. What's your answer—yes?

A. I said, yes.

Q. On page 66, referring to the various tests that you made—it wasn't just a case as to what products you are using—

A. Which test are you talking about now?

Q. From XQ194.

A. All the tests that we had made and were known at that time convinced me that the product that we were getting was a low oxidation product.

and whether the lead was combined in that shape nobody knew. I didn't profess to know.

Q. In the Interference, you were testifying, in effect, that the material was discharged from the mill by being blown out, thus making the distinction of the finer and the coarse material, on page 74, did you not?

A. Page 74. Which question?

Q. 244.

A. Of course. I was referring to the stuff that floats in the air and was going out because nobody was using his head—because it naturally discharges of its own accord.

Q. Does the air aid or detract in discharging? Does the air aid or detract in discharging the heavy material from the Hardinge mill?

A. I don't think it would amount to very much one way or the other.

When you start with an empty mill and charge it, low oxidation material comes out first, that's the product. That has a small amount of PbO, probably twenty per cent. It is a black color. Maybe it starts in very black; then in the course of an hour, it gets lighter; and in two or three, or three or four, hours. it ought to be producing stuff that is olive gray. I don't think the defendant company had a mill cleaned out and started up with a fresh charge in 1928 or subsequently thereto. There was an accident, caused by one of the men turning the motor on and it wrecked the gear. And my best recollection is that was in the early part of 1927. They have been just as you saw them, Your Honor, starting and stopping. They haven't been cleaned out. That one was on account of the wrecking of the gears. My best recollection is that it was the early part of 1927. I think it was the one to which Mr. Cooper referred. He was probably mixed up on his date a little bit on that. I think he

said it was the latter part of 1927 or 1928—I don't know which he said, but it was something of that sort. I looked it up at the time that statement was made, and I went over our records, and I could find no record of the mill being dumped from June 1, 1927, which was six years prior to the filing of the suit. That's the best evidence I can give you. They always make a record of it. I had the men go over all our records. When we started up after a Sunday's shutdown, we got the same color of lead. It comes out quite yellow first; then, maybe for a couple of drums, it darkens a little bit.

Q. Well, you have taken the position that the testimony you gave in the Interference was not correct when you gave it?

A. No.

Q. You now say the testimony you gave there was correct?

A. The nearest I could recall at the time. I gave that testimony—at the time I gave that testimony, I gave it to the best of my ability—that everything in there was correct.

(Witness excused.)

MR. MORRIS: If you Honor please, may I read of record some information which the other side have asked for—and I have just a little more, which I will have in the morning. Mr. Reinhardt was asked to supply or to tell us the percentage of the Willard's entire production that was produced by the German mill when the German mill was being operated by the Willard Company.

THE COURT: Yes.

MR. MORRIS: Well, I am advised by Mr. Reinhardt as follows: Lead dust manufactured in two

months of 1920 was equivalent to approximately one percent of litharge—and that, translated into the information we desire here, as I interpret it, is that the product of the German mill was approximately one percent of the Willard's requirements.

I have like information from the Defendant for the years 1922 to 1934, inclusive, and we have at the hotel—at the hotel, I think there is some information—the hotel, I think, has some information that was supposed to be in at noon about '16 and '18, which I will give your Honor in the morning.

This is the amount or the percentage of the product produced by the Electric Storage Battery Company, of their entire product or material used. The percentages were as follows:

In 1922, we produced 5% of our requirements.

In 1923, 9.6—that's the percentage—of our requirements.

1924, 25.2 per cent of our requirements.

1925, 41.3 per cent of our requirements.

1926, 51.2—or 5—percent of our requirements.

1927, 56 per cent.

1928, 59 per cent.

1929, 63 per cent.

1930, 65.4 per cent.

1931, 69 per cent.

1932, '33 and '34, 75 per cent, for each year, of our requirements.

I hope to be able to give your Honor in the morning like information with respect to the years 1916 to 1918, inclusive.

(Discussion off the record.)

MR. MORRIS: So far as I know, I am about ready to rest, but I should like, if your Honor please, if you will grant me the indulgence, to check it up with my data tonight.

THE COURT: Oh, yes.

(Discussion off the record.)

THE COURT: I wouldn't hold you to it, if you found you had forgotten, anyhow.

MR. MORRIS: Thank you, very much, but I think I can do it with five minutes, in the morning, anyhow.

THE COURT: Yes.

(Discussion off the Record.)

MR. MORRIS: May I offer in evidence the Plaintiffs' answer to Defendant's interrogatories, as the Defendant's Exhibit 184.

THE COURT: Yes.

(Said answer to interrogatories was then marked as the Defendant's Exhibit No. 184.)

(Court adjourned to ten-thirty A. M., Thursday, October 10, 1935.)

DEFENDANT'S EVIDENCE (Continued).

MR. MORRIS: May it please Your Honor, the percentage of the product of the defendant in this case made by the German mill, so-called, in 1916 and '18 was slightly less than one per cent of the entire requirements of the defendant.

It is stipulated and agreed, Mr. Betts, by and between the respective parties that payments were made to the defendant in this case by the New York Railways Company for the batteries made of the lead dust made in the German mill in Philadelphia under and in pursuance to and in conformity with the terms of the contract with New York Railways in that regard.

MR. WHITCOMB: That is all right.

MR. MORRIS: I offer in evidence as Defendant's Exhibit number 185 Dr. Ullmann's notes re heat of reaction for the gray oxide. It is just the same as yesterday, I think, with certain minor changes and certain recitals clipped out. I have the recitals that he has clipped out if you want to see them.

(Notes of Dr. Ullmann relating to heat of reaction were marked Defendant's Exhibit number 185.)

I offer in evidence as Defendant's Exhibit 186 the German patent to Shimadzu number 487,700, a photostat copy of it, and the translation. The translation, of course, is always subject to correction.

MR. WHITCOMB: Is that in the answer, in the pleadings?

MR. MORRIS: Oh, no, no, but you put in the file wrapper and contended that you got a broad German patent, and we do not so read it. We are putting it in to let the Court determine.

MR. WHITCOMB: You have the whole file.

MR. MORRIS: You don't have the patent in, though.

MR. WHITCOMB: All right.

MR. MORRIS: The translation is 18-A.

(German patent in Genzo Shimadzu number 487,700 was marked Defendant's Exhibit number 186.

Translation of German patent to Genzo Shimadzu number 487,700 was marked Defendant's Exhibit number 186-A.)

MR. MORRIS: Mr. Whitcomb: Can it be stipulated that the apparent specific gravity of the Berzelius oxide is between one and three?

MR. WHITCOMB: We don't know that, of course.

MR. MORRIS: All right, may I wait until after rebuttal to put that in, if Your Honor please? If Dr. Clark doesn't know it—

MR. WHITCOMB: We don't know that, I guess.

EDWARD CLOCKER was called as an expert witness on behalf of defendant and, having been first duly sworn, testified as follows:

Direct-examination.

By MR. MORRIS:

I am a graduate of the Lehigh University. I have been doing special work in the Chemistry Department of Lehigh this year. I have ascertained what the apparent gravity of the Berzelius oxide is. I found it to be 1.215.

Cross-examination.

By MR. WHITCOMB:

I made the oxide under a vacuum at 280 degrees

Centigrade. I placed lead oxalate in a 125 C. C. Erlenmeyer flask, heated it to 280 degrees Centigrade under a vacuum, and left it there for twenty-four hours, flooded it with nitrogen, and removed a sample in an atmosphere of nitrogen.

MR. MORRIS: I offer in evidence as Defendant's Exhibit 187 a translation of the Berzelius article that has been referred to from time to time in the testimony.

(Translation of Berzelius (1) Lehrbuch der Chemie, fifth edition, Vol. 2, pp. 611, 612, 1844, was marked Defendant's Exhibit number 187.)

MR. MORRIS: Can it be stipulated, Mr. Whitcomb, that the Toronto samples were taken, that the Toronto samples were taken by Dr. Wilson and that the samples that have been referred to, the Toronto samples that have been refererd to in the case so far and that have borne his initials were taken by Dr. Wilson impartially for the respective parties?

MR. WHITCOMB: Absolutely, sure.

MR. MORRIS: What, may I inquire, is the situation with respect to the numerous log sheets of the defendant that were brought to this court on Thursday of last week by Dr. Wilson, having been selected by him at random from all the records of that character of the defendant company?

MR. SCHAFFER: The log sheets will be returned. We have them at the hotel and they are now ready to be returned.

MR. MORRIS: I see.

MR. WHITCOMB: We didn't know they were here for some few days.

MR. MORRIS: Then it is stipulated and agreed by and between the respective parties, or not, that the log sheets selected by Dr. Wilson have been inspected by the plaintiffs and will be returned at the conclusion of the case by plaintiffs to defendant?

MR. SCHAFFER: It is so stipulated.

MR. WHITCOMB: Well, we want to look them over—

MR. MORRIS: Then I don't know whether it is so stipulated or not. I don't want a stipulation if they don't want it, but somebody said, "It is so stipulated", and then Mr. Whitcomb—

THE COURT: Yes, is it or isn't it?

MR. WHITCOMB: You mean without introduction, is that what you are driving at?

MR. MORRIS: No.

THE COURT: No, all he wants to get in the record—

MR. WHITCOMB: Absolutely.

THE COURT: —is that you have the sheets and have examined them.

MR. WHITCOMB: Oh, certainly. I thought he meant to preclude our putting any in.

MR. MORRIS: If you put any in you will put in a fair cross section of them, not any irregular days. I don't know what they contain.

Then, lastly, I am not just sure, notwithstanding I think Your Honor was good enough to advise me at one time earlier in the case, whether I should make a request at this time that

all the exhibits that have been offered by defendant and numbered should be formally accepted.

THE COURT: Well, it doesn't matter, I will receive them all in evidence—

MR. SCHAFFER: The same request is made on behalf of the plaintiffs.

THE COURT: —subject to any objections that may have been made to any particular ones.

MR. MORRIS: Oh, yes.

THE COURT: As to those which were not objected to, they will be received in evidence, and the others will be ruled on at the time the case is disposed of.

CLARENCE A. HALL, a witness on behalf of defendant was recalled.

Cross-examination (Continued).

By MR. WHITCOMB:

I filed my application for patent about March 29, 1924. As a part of my duties I follow the chemical abstracts relating to processes relating to our business. I did observe the chemical abstracts appearing in the chemical journals of March 10, 1924 that referred to certain Japanese patents by the plaintiff in suit here, Genzo Shimadzu. That has all been gone over in the interference, and I testified at that time that I did not see that particular copy until after that patent was filed. I so testified. I testify the same thing now. I have some thirty and forty magazines to go over and they sometimes accumulate, and I did

not see that until after my patent application had been signed, which was the 28th of March, and the patent records shows the 29th, when it was received in Washington.

MR. MORRIS: Well, if Your Honor please, I do not think objections are much use in a patent case or any other case, but we are not trying the Hall issue here, and I just do not see the pertinency of this inquiry.

THE COURT: Well, I will have to note the objection and take it subject to it, because I do not myself see—

MR. WHITCOMB: Sure.

THE COURT: —what it is leading up to.

MR. WHITCOMB: Well, we would just like to have of record that these were published at that day.

MR. MORRIS: I will stipulate it if you will produce the article.

MR. WHITCOMB: Well, here they are, several of them. These different titles are all written down here. All appeared before he filed, one, two, three—

MR. MORRIS: Well, I never heard of but one. I will have to get Mr. Hall to look them over. If he will look them over and Mr. Hall says it is all right I will so stipulate.

THE WITNESS: Judge Morris, we have the chemical abstract for that particular number in our files and we can have that taken out of that. That thing was all hashed over in Washington, they tried to infer that I saw that.

MR. MORRIS: If you will talk to somebody about it I will stipulate whatever publications were made before.

MR. WHITCOMB: Well, particularly I ask with respect to the reference to the Japanese patents 42,562, 42,563, 42,564, 44,223, 42,048, 44,222, 43,562, 40,704, 37,620, 41,728, 41,953, in the chemical abstracts appearing in the chemical journals, some in February 10, 1924 and others in March 10th, 1924.

THE WITNESS: I don't know that there was anything in February 10th, I thought it was March 10th. There were three or four patents,—

MR. WHITCOMB: Yes.

THE WITNESS: —but I wouldn't say that your dates are correct without getting the journal, because you may be mistaken on that.

By MR. WHITCOMB:

Q. Well, will you do so and check it up?

A. Be very glad to. I have got the journal there which we can check up.

Q. The February 10th, as well as the March?

A. We haven't any February 10th here. Have you got a February 10th? My recollection of the first reference to any Japanese patents was March 10th.

MR. MORRIS: You better work that out. I withdraw my suggestion of stipulation.

MR. WHITCOMB: Well, subject to correction we will produce the February 10, 1924 journal and see if some of these I have listed do not appear in there.

THE WITNESS: Well, you will have to. I don't know how I will remember all those numbers. I suppose I can get them from the record.

In my patent application I referred to the use of 150 cu. feet of air a minute. As an example of one way of running the thing, and the patent covers anything from low to high, and, therefore, you would use a small amount of air, large amount of air, and that is a particular example. If you take the whole definition of the patent I think you will find that particular example is perfectly all right for that particular product. According to Dr. Wilson's report, we use at least 300 cu. feet of air now. That is right. The regular product has been manufactured with 300 cu. feet or 350, it is a slight variation one to the other, to my best recollection for about eight or nine years, or probably ten years. I don't remember the figures as to the rated capacity of the number three Monogram fan that we employ and the speed at which we run it, but I know it gives a large amount of air if you just take it as free air. But if you back it up against bag pressure and various things like that, why, you don't get that amount of flow. The amount of air that that fan delivers at the rated capacity has absolutely nothing to do with the amount of air going through the mill. I imagine it must have been that capacity in order to draw a certain amount through the mill, counting the resistance. You have to have a certain amount of pull there to get air through the mill, the amount of air you want. The air going through the mill is between three hundred and three hundred and fifty cubic feet. I haven't the slightest idea what proportion of the capacity of the fan the resistance of our system gives to its capacity. We kept on getting lar-

ger fans until we could get the amount of air through the mill that we wanted.

Q. And you desired to increase the amount of air, is that right?

A. Three hundred cubic feet is what we wanted for this particular product. At one time, at least, during the time of the filing of the application we were using one hundred and fifty cubic feet, we were getting a small amount of product out. We doubled the air intake, and doubled the product too. The rate of discharge and the amounts of charge in the mill was nineteen thousand pounds I think, as described in the patent, and that is what we have been using ever since. We have had a speed of fourteen revolutions almost from the start. The rate at which I feed the balls is according to the material as it comes out, making, of course, allowance for the increase in oxidation. If you get four hundred pounds out, why, slightly less than four hundred pounds to always maintain your load of nineteen thousand pounds. At the date of the application or thereabouts we were feeding about 480. You are just taking that one example in there and trying to pin everything down on that. That is just a typical example of what you can run. I ran some at that example in 1924. Since then we now feed enough to get out eleven hundred pounds of material in the same mill. The R. P. M. is the same. The size of the drum is the same. We changed the size of the ball. It was a larger ball than was originally used but the load of nineteen thousand pounds is the same.

We experimented with lower oxides. We went on as I explained yesterday until we got an oxide that was most suitable for our plates, and that was 66 to 68 per cent and we made it then and have been making it ever since for our factory work. That was

way back in 1921. The testimony given in the interference in 1928 was given then in reference to that low product and not to this other product. We tried to use the other product commercially but it was never successful. I don't think Willard used the low powder. That was a guess. I stated I knew of the German mill before I filed my application. I worked at the Storage Battery Company in 1906 for about a year and a half, I suppose, that is all. Then I went back on July 5, 1920. I had all the data on the German mill and so testified, everything that had been done up to that time was handed to me. The powder from the German mill is a different product from that I made under my mill.

MR. MORRIS: Well, I am wondering, if Your Honor please, if the patents of Mr. Hall do not speak for themselves in that regard. It deals with a specific type of product, it deals with the range in percentages, and those patents are in evidence, but I only call that to Your Honor's attention.

MR. WHITCOMB: But you must remember those very claims were adopted by this man in his Interference, and he claimed to have made this same product.

MR. MORRIS: No, as I understand the Interference—

MR. WHITCOMB: Some of these product claims were—

MR. MORRIS: Precisely, but may I have Plaintiffs' Exhibits 16 and 17, Miss Johnson, please—17 and 18? All this that I see is of an amorphous lead oxide powder of olive-gray color, and so on.

MR. WHITCOMB: You are reading the detailed patent that Hall finally got after he lost the Interference to Shimadzu.

MR. MORRIS: Sure, I am.

MR. WHITCOMB: But the very claims in issue—

MR. MORRIS: In the Interference?

MR. WHITCOMB: —in the Interference are in suit here.

MR. MORRIS: Oh, then I misunderstood you. I thought you were talking about the claims in the Interference; sure, you are right in that, but still I do not see the pertinency of this inquiry.

THE COURT: Well, I know, but I am not sufficiently familiar with the Interference to rule on it now, and I will have to take it subject to the objection.

(The witness resuming testified):

The patent application that I filed which had the claims in it was the patent that was finally allowed to me. Those claims were never changed. It was the additional patent claims in the Interference that were the things that were dropped out. That describes a product that is gray in color and does not burn, if you put water on it it makes mud, and it has different properties than the Tudor product. Does that answer what you—

It is different. I am describing the gray oxide. I say it has a gray color, it does not burn in the air when you put a match to it, if you put water on it it makes mud. This is the gray oxide that we now make. You are asking me to describe the product. I am

giving you my description. Comparing the product that you claim was the result of the apparatus and process of my patent application with the product of the German mill, the product of the German mill was something that would burn, and when you dropped water on it it would continue to oxidize. It had different properties from the properties of gray oxide, physical properties. I don't imagine there is any chemical difference but there is a mechanical difference in the way those chemicals are mixed. Because of my association with the various people that have worked on the product of the German mill, now, I am giving you the information which they have told to me. I understand that the very fine material in both products is just about the same. But when you are talking about screen products there may be some varition from one to the other. I don't state they are substantially the same. I don't think you realize the difference in the product. I have told you the difference, but you don't seem to understand that. The mechanical differences make a very different physical product to use. The differences resolve themselves into the difference in the way those things are mixed together, not necessarily the proportions of large and small. One may have the oxide on the outside and the other may have lead on the outside, and you get a dark looking powder in one place that burns; in the other you get a product that won't burn on account of the oxide which is on the surface. You see, Judge, the process in which the gray oxide is made in the Hardinge Mill, it is mauled through this amount of partially oxidized stuff, as it goes out the end; and in the Tudor Mill the stuff drops out and it doesn't go through a mass of oxide, so that our stuff is coated with PbO, where the other material that drops out of the mill has got a coating probably of

very fine particles of lead. I suppose you could make a mixture of large and small particles in which the large particles will be outside of the small particles. I don't know but you can have just as small particles of the lead oxide as you can of the lead. They are both small particles, really both covered with particles, we will assume, of the same size. If one was coated with small particles of PbO and the other was coated with small particles of Pb, they would look very different, they would act very different to the air and water. They would look very different if you took black and white particles and then the other is different in that you are liable to have the stuff to ignite in your drums and catch fire, and all that kind of trouble in the factory, which is a hazard, whereas this material, there is no hazard in handling the stuff. Where I say "this material", I mean the gray oxide.

I said that my patent application gave one example. By varying that example I can get what Exide produces today by that same disclosure. If I may have the patent I would like to read the one sentence in there which I think may help you. We can make the gray oxide of the present production strictly in accordance with the disclosure of my patent by selecting one of the methods or one of the rates disclosed there certainly. Yes, absolutely. It is within the range of this disclosure. It says here: "It is not the intention to limit the invention in respect to the size of the lumps or balls of metallic lead or to the exact size and speed of the mill, or to the quantity of the air, or to the temperature of the reaction, as they may be varied in accordance with practical requirements. Control of these factors, however, is the spirit of this invention, whereby any product once

established may be kept substantially uniform in quality."

Re-direct-examination.

By Mr. Morris:

I told you yesterday that what I was referring to in Washington was my black oxide and what I was manufacturing and had been manufacturing for years and years in my process at E. S. B., is the gray oxide. The amount of PbO in the low, that is, the black material, is less than the amount of PbO in the gray oxide.

A. Yes.

Q. Now, Mr. Whitcomb asked you a moment ago if there was any chemical difference between those two products, and I understood you to tell him so. Is that right?

A. The amount of PbO in the low, that is, the black material is less than the amount of PbO in the gray oxide.

Q. So that, then, there is a chemical difference to that extent?

The Court: Judge, I may have misunderstood him, but I thought he said they were the same chemically, the German product and the black oxide. Isn't that so?

Mr. Whitcomb: We also.

By The Court:

Q. Weren't you saying that the German product did not differ chemically from the black oxide, or did you say that? If not, why, don't leave me under the impression.

A. It is pretty hard to recall just what I said,

but if I may clear the situation, all these products contain red PbO and metallic lead. Now, it is a difference in mechanical mixture for those products whether you have the German product or whether you have gray oxide. "Distribution" is better. Different distribution of those. If you have the Pb in the inside and the PbO on the outside of one, and in the other you have the PbO on the inside, we find under the microscope that there is a difference and the various men that have worked on it say that is the difference. The whole mass of material that comes out of the Hardinge mill from—the very nature of the Hardinge mill is a lot of material at the end, fine material, which is not quite fine enough, it hasn't worked out. Now, all the stuff goes through that, and if you take something and roll it around in flour, take some black particles and roll them around in flour, won't that flour stick to the outside? Now, that is what happens to our product. We got a variation from small amount of, almost colloidal material up to stuff that goes through 100 mash. There we have a different problem, but your problem where they are all the same size, I think probably you are correct, but where you have such a wide variation of sizes, I think that as the microscope shows, that our product of gray oxide is surrounded with PbO, and that is the reason it is gray, where as the Toronto product which was the German product, is black, because it has got a thin coating of lead on the outside. If you have a theoretical mixture, all the sizes were alike, I would agree with you. But if you have such a tremendous variation in mass I think that that would not hold.

THE COURT: Well, I guess we all agree on the thing.

MR. WHITCOMB: Yes, sure.

MR. MORRIS: Well, the testimony is that that contains, the Toronto product contains substantially the same percentage of PbO and the same percentage of lead as the one is our gray oxide,—

THE COURT: Yes.

MR. MORRIS: —now, so that it is obvious from a glance that there is a difference of physical distribution.

THE COURT: Sure.

MR. MORRIS: And the testimony also of Dr. Ewing is that the particles, the finer particles are substantially of the same degree of fineness in those two, that there is some difference in the extent of size of the larger particles. I wonder, without carrying that theory further, whether there might not be something in Mr. Hall's suggestion that in the gray oxide the particles are not removed from the mill immediately upon being formed but they are rumbled in a bed of oxide, as Your Honor saw it in this little whirligig we had here,—

THE COURT: Yes.

MR. MORRIS: —that the sand worked out towards the end, but there is always sand being rumbled down underneath the balls, although it is being fed toward the outlet by the action of the mill, so that the object of my question was merely to call Mr. Hall's attention to the fact that in one of his answers he had not specifically stated that between—that there was no chemical difference between his black oxide, as I understood it, and the gray oxide, although he had testified—

THE COURT: All right.

MR. MORRIS: —numerous times that there was a difference in the percentages.

(The witness resuming testified):

We got a larger output with larger balls, and the amount of air that we used was substantially the same, in other words, we used up more of the oxygen in the air that was going through. We used more, but we did not have to change our volume because we had an overplus in the smaller balls. You see, the smaller balls are all so tight together that the larger ball has more surface openings in between.

Q. Mr. Hall, learned counsel for the plaintiff has been making inquiries about your application in 1924. I now inquire how long the Hall mill had been running prior to the filing of your application.

A. We started in '21 to run the Hall mill.

Q. Very well, now, then, I would like to put this question, but I don't believe I ought to. If the other side objects or Your Honor objects I won't press it. I would like to ask you, Mr. Hall—don't answer this—did you find any more instructions, any instructions at all in patents 149, or 150, or 151, or 152, or 479, or 020 as to the volume or amount of air that is to be put through a Shimadzu mill.

A. I have read all those—

MR. WHITCOMB: Of course, we didn't ask him about the Shimadzu patents.

MR. MORRIS: Of course not, but they asked him about the disclosure of March 10th, and would have Your Honor draw the inference Mr. Hall copied it. There isn't a word in the patents about it.

THE COURT: Well, I guess the main thing is that Judge Morris's question is on the record.

Re-cross-examination.

By MR. WHITCOMB:

We did not use hollow balls when we increased the size but that introduces a very beautiful question. Those balls start solid, and as they are worn down a hole develops inside, and it has been the subject of much discussion why the thing gets a hole inside of it, so finally the hole inside gets larger and the outside gets smaller until you get such a thin shell and the ball just collapses. That ball starts solid, and, Your Honor, with the smaller balls we never could tell, it got down to about pea size and then we never could find anything, and it wasn't until we went to the larger balls that we commenced cutting them open and finding this hole.

DEFENDANT RESTS.

PLAINTIFFS' EVIDENCE IN REBUTTAL.

GEORGE L. CLARK, a witness on behalf of plaintiffs was recalled.

Direct-examination (Continued).

By MR. WHITCOMB:

Q. Now, Dr. Clark, you have heard testimony of defendant's in connection with the various testimony you gave and exhibits and data you submitted.

THE COURT: You mean the defendant's witnesses.

MR. WHITCOMB: Defendant's witnesses, pardon me, please.

By MR. WHITCOMB:

Q. I understand you have a list of items you desire to take up, and will you please go ahead and state on the record what you have to say in connection with the various items mentioned by defendant's witnesses?

A. What I shall have to say will be very brief. I think it is entirely unnecessary to repeat my own testimony or theories.

First of all, of course, the X-ray, the discrepancy in the X-ray results. I have the highest respect for Professor Davey and Professor Anderson and their work, of that there isn't any question at all, so that the matter simply devolves into attempting to reach a common ground or to analyzing wherein differences might lie.

In the technique, first of all, there seemed to be only two fundamental differences in technique. One was the type of and the method of holding the specimen. Both Professor Davey and Professor Anderson used sealed capillary tubes, while we used a wedge of the powder itself.

Another difference, of course, is that in the samples in issue we have utilized always, of course, vacuum in our cameras, vacuum camera. We used in the early part of the investigation, as I have a ready stated, a General Electric apparatus, and abandoned it because I felt that the films were not good enough to prove anything one way or the other. Now, what effect the vacuum camera has, of course, is difficult to

say. We found on recent investigations, especially on complex materials of various kinds, that vacuum in the camera makes a very profound difference in bringing out certain interferences which would be very difficult in the case if the beam were scattered by air. Of course, that is true the longer the wave length, we would have been unable in recent studies of living nerves, and things of that kind, to have obtained the information which we did, we would not have been able to bring out except by eliminating the air completely from the camera and the use of the vacuum camera.

The second point of possible difference, of course, has to do with the specimens.

By The Court:

Q. Pardon me, but you said there was a difference, in the way the object was presented to the camera, but you did not comment on it. Is there any—

A. Yes, well, I did try to before. It seemed very desirable to get rid of any containing walls of any kind of a foreign substance, like glass or anything of that type, and what was done, the question has been raised, I might describe a little bit better, is a little cradle with a sort of a peaked end—

Q. Well, I was not particularly interested in that. You simply pointed out that there was a difference, and I was wondering whether you felt that one was better than the other.

A. Yes, well, I feel, of course, that if we can eliminate any foreign—the effects due to anything foreign whatever in the path of the X-ray beam that we should have a more accurate picture of the particular specimen. That may or may not have this effect.

Q. All right.

A. Again, it is fair to say that I could not prove anything one way or the other by the early technique.

Now, it has been suggested that those specimens which seemed to give different results might be different, in other words, that my specimens might contain additional substance, carbonate, or something of that kind. Of course, there are always human limitations, I presume, in a thing like this, but in all of these cases where—especially of these Dr. Wilson's samples, the utmost precaution has been used. The exposures were taken in vacuum, as already described, and every precaution was observed so that they would not, the additional substance could not be formed. I simply make the suggestion, therefore, that there is an alternative way of looking at it other than that mine might have contained an additional substance. That, of course, is simply that Dr. Anderson's and Dr. Davey's might have lost something.

In the third place, let us take up the lines themselves. They are weak, broad, diffuse, and, as already indicated, somewhat variable in composition, and it has been suggested that some of them has submitted, that is, when the average was calculated, some of them or some of the lines could be made to fit lead carbonate, and lead oxalate, and yellow PbO, and red PbO, and, of course, would fit an approach, at least, to a cuprite type of structure, since the maximum deviation of two of the lines is two per cent.

Now, I would not necessarily limit the possibilities if we just select a few lines to these particular substances. We might have, we could match some lines with sodium chloride, maybe, or with urea, or with almost anything of that sort. In a case like this the best judgment has to be used, not in selecting fractions or fragments of patterns, but to make the

whole picture fit as well as possible. These patterns, these weak, broad, variable lines, have been obtained from mill oxides, from layers on balls, from oxalate experiments, and when I say oxalate experiments I include those of which there can be not the slightest question of complete decomposition, that is, heated at temperatures for twenty to twenty-four hours, and things of that sort. We have one hundred and twenty-five or more experiments of that kind, as previously described.

But let us for the moment take up these suggestions that have been made. I might—I might add, also, to the previous one, of course, that we find these same strong lines in the fractionated sample, and, at least in one instance, in an experiment made of exposing metallic lead to oxygen, where the lead was very carefully melted and dropped into oxygen-free water to reduce the grain size, and the surface very carefully removed, and a fine powder produced.

Let us consider these compounds, lead carbonate, for example. Some of the lines by the usual powder method in the series of curves shown by Dr. Davey unquestionably approximately fit here and there, there isn't any doubt about that. On the other hand, the centrifuge sample which showed these strong lines, the strong lines which corresponded to the average of these other very weak lines, does not effervesce or liberate CO_2 when treated with acid. It blackens on heating at vacuum, as already described, and when heated in air it becomes yellow PbO, which can be pretty well identified by sight. The lead carbonate, if the additional third substance found under the microscope is lead carbonate there certainly is no evidence of that at all. Lead carbonate is biaxial. It has a refractive index widely different from that

which is measured on these little semi-transparent or transparent clumps. As stated yesterday, its value was 2.553 plus or minus .002.

By Mr. Whitcomb:

Q. Pardon me, Dr. Clark, when you refer to, when you are differentiating from the carbonates and you point out these things that happened is your testimony that if it were—that they did not happen, rather, whereas if it were carbonate that would happen? Will you make that very clear, please, about the blackening?

A. Well, what I simply mean is this, that with such tests as we made on the centrifuge sample, producing these strong lines, when the centrifuge sample was tested there was no effervescence or evolution of CO_2 with dilute acid.

Q. Would there have been if there was a carbonate?

A. If there had been lead carbonate there would have been, yes.

A well-known test of the mineral cerussite, for example, is the evolution of CO_2 by dilute acid. The compound blackens on heating in vacuum; that is, the centrifuged had not actually blackened on heating in vacuum, which, of course, lead carbonate would not do. In air the centrifuged sample changed to yellow PbO, of course, which carbonate might do, and finally, if we associate the third substance microscopically observed with the additional substance which is presenting itself in the X-ray patterns, the microscopic examination both in polarized light and by refractive index certainly indicates it is not lead carbonate.

Turning to lead oxalate—I may say, of course, in connection with the preceding, too, we have stand-

ard patterns of lead carbonate, and have always been anxiously on the lookout for any matches of that kind.

Q. And you found none of this substance?

A. There is no—there is no accurate match of this pattern in its entirety with a standard pattern for pure lead carbonate, although it is perfectly true that rough checks or matches can be made with some of the lines, as already indicated.

Lead oxalate has been mentioned. We have many films with oxalate lines on them from our oxalate experiments, many of them, some made at 305 degrees, 300 degrees, and even higher temperatures for short periods of time, and checked against the pattern for pure lead oxide.

MR. MORRIS: I can't quite hear you, Dr. Clark, I am sorry.

THE WITNESS: I am sorry; I say we have many films, we have made many films of oxalate samples which show undoubtedly oxalate lines, that is, at 305 degrees and 300 degrees, lower temperatures, and so on, and, as a matter of fact, we probably have one or two films at 310. That is exactly the reason why I said it was so extremely sensitive.

On the other hand, of course, we have films, as indicated a while ago, for products at higher temperatures for varying periods of time. I simply suggested that in film C-119, which was made at 310 degrees for two hours, there seemed to be there a maximum intensity of lines which checked with this, with the average of these, from these other determinations.

Oxalate, of course, is not produced in the mill. I don't think that anybody could believe that, or on the balls. I don't believe that I have made it clear,

our experiment with the lead balls as received from Dr. Wilson—

THE COURT: I can't quite hear you.

THE WITNESS: I say I don't believe I made it clear just how we experimented with the lead balls from the mill. The whole ball was used as a sample, mounted in a camera with nitrogen, and a beam of X-rays very carefully adjusted right across the top of the ball, just so it would skate right across, or be tangential to a surface, and the corresponding patterns were made, the patterns in evidence were made in that way. Then a little, very carefully, with a razor blade, just the tiniest bit of the outside layer was removed, and another photograph made with the same ball in the same position, and so on, down through, through various layers.

The tabulation, of course, shows that in the inner layers these weak, diffuse, broad lines appear in somewhat greater intensity than from the outer surface of the ball, and, of course, under those considerations I feel that we could not pin the pattern upon lead oxalate.

Our chemical analyses are only very approximate. Of course, lead oxalate would have only seventy per cent of lead in it, and, of course, if our centrifuge sample were completely lead oxalate, the analysis, which was in the neighborhood of ninety-five per cent, of course, would almost certainly eliminate the possibility of it being a large per cent of lead oxalate.

We turn to yellow PbO. Admittedly, again, it is an orthorhombic substance. These lines, some of them, possibly many of them, can be and are roughly matched to some of the lines which we have observed.

The yellow PbO we have worked a great deal with in connection with other problems, and we think we know quite a bit about yellow PbO, and especially its transition to red PbO. In a mill sample the grinding process is absolutely opposed to the existence of yellow PbO. Yellow PbO is stable as a high temperature modification, is converted easily by grinding at room temperature into the red tetragonal form. That can be demonstrated easily by anyone, and I do not think there is any evidence whatsoever that there is yellow PbO in the oxalate experiments at the—under the ordinary conditions. Of course, the microscopic examination again indicated—indicated not the presence of a biaxial crystal like lead oxalate or yellow PbO.

Red PbO has been suggested; perfectly willing, perfectly admitted that a few of these red PbO lines, three or four of them, almost exactly coincide with the patterns under consideration. We obtained such—such excellent patterns for red PbO, and the lines are so perfectly definite, and we can measure them so accurately, just as Dr. Davey and Professor Anderson have done, that, of course, there is no complete correspondence between the patterns at all, except with respect to an approximate superposition which we have recognized, of course, from the very beginning, and in the centrifuge sample, for example, of course, the most essential lines of red PbO are completely missing. I do not think the centrifuge sample could possibly be that. We have fractions scraped off of the walls of the super-centrifuge, which show the well-defined red PbO structure. Of that there isn't any doubt at all.

Then if we take these lines from another point of view, we have seen they vary somewhat from one substance to another, they are broad and diffuse,

somewhat difficult to measure. We have used the microphotomether, and I feel in spite of some objections the microphotometer is a very useful subsidiary auxiliary to help us in them. When we take this average as shown the other day, two of the lines show a maximum of two per cent deviation from the theoretical match for a cuprite-like type of structure, and this, as we have indicated, these patterns are very similar, of differing intensity, of course, for mill oxides, where they were very, very weak, centrifuged samples, lead oxalate, lead and oxygen, they have never been found in many specimens which we have examined, we have never found them in any reduction, any reduction process at all. Now,—

By The Court:

Q. What is a reduction process?

A. Where we reduce an oxide, a higher oxide, to a lower one, by hydrogen or hydrazine, or something of that sort.

The Court: They want to relieve the stenographer. I suppose we might take five minutes.

Mr. Whitcomb: If you don't mind.

(Recess at 11.45 o'clock A. M.)

George L. Clark, recalled.

Direct-examination (Continued)

By The Court:

Q. Now, will you resume, Doctor? Before you do you might tell me one thing that I didn't grasp and

that is as to just how the slicing of the lead balls you referred to eliminated the possibility of the presence of oxalate in the photographing of the successive slices?

A. Yes. That's simply this, if oxalate were present it would mean, of course, lead oxalate would be formed in the Exide mill, and there has never been any evidence of a complete or definitely identifiable pattern of any product made in these mills that corresponds to lead oxalate.

Q. You took a solid lead ball—

A. Yes.

Q. —and you took a razor blade and sliced it?

A. Yes.

Q. And as they got deeper there was a difference of some kind. You said that eliminated the possibility of lead oxalate being there. I don't know why but I didn't quite understand that.

A. I was simply trying to explain the technique in some more detail. The outer surface, when examined, when it produces such a pattern, gives a pattern corresponding to, very nearly, a high percent of PbO tetragonal, a little lead, and only the very faintest evidences of additional substances. As we go down in under this outer layer and in more or less intimate contact with the lead, these additional, that is, these extra lines become stronger, as if something were more or less in greater concentration.

Q. I can see that, how it strengthens your conclusion that Pb_2O exists, but I don't know how it eliminates the oxalate.

A. Well, that, by itself, would not necessarily eliminate the oxalate, except that we assume that lead oxalate is not made in an Exide mill.

Q. All right. What that experiment really does

is to fortify your conclusion that the thing you get is Pb_2O and, of course, it follows, as that conclusion becomes stronger and the possibility that it is something else becomes weaker. I suppose that's what you had in mind, all right. I thought there was some well-known chemical reason why. I understand it now, go ahead.

A. We were just at the place of considering very briefly, these lines having eliminated the correspondence with lead carbonate, lead oxalate, yellow PbO, and red PbO, and taking this substance with its variable lines, where we find by calculation which, of course, Dr. Davey made the other day, two of these lines—we just take an average of these variable lines, showing that two of them have a maximum deviation in the whole spectrum of about two percent of a rheoretical match with a face-centered type of lattice or cuprite type of lattice.

This I have, by long thought and consideration of this particular pattern, I felt to be consistent with the principles of the addition of oxygen to lead, the principles of a varying solid solution of lead—the point being that if the evidence of this particular material, being no experimental evidence, measurable experimental evidence, of metallic lead with a tiny bit of oxygen in it. You couldn't measure that, but evidence of the fact, some evidence is present here, showing, even with variations, the approach or the attempt to confirm an intermediate type of structure represented by the distorted cube or something of that kind.

Now, this undoubtedly, although the pattern is different—I mean, is similar in showing a rough correspondence to the face-centered lattice, I think, better than the other or than any other possible substance previously mentioned. It must differ from

silver oxide and cuprous oxide, that is, the particular compound, because it is so unstable and these other two substances are so stable, and also in the fact when we calculate or make a theoretical calculation on the basis of lead and oxygen for this thing which is indicated here, that the lead atoms would have to have a size very nearly the same as they possess in the metal itself.

And, of course, there we enter a twilight zone about which there is some, not very much definite information about the actual valence forces that are concerned, but certainly they must be considerably weaker than they are in silver oxide, that is, where the electron, completely to the oxygen and copper, loses the electron and the result is that the silver and the copper ions have appreciably different sizes, than correspond to the sizes of those of silver and copper in the metals.

However, we have analogous cases, as already mentioned. We have palladium and hydrogen—that's a system which has been studied more than anything else, I suppose, along this line. Palladium takes up hydrogen continuously and passes through a state which is called PbH, and yet represents a continuous take-up of hydrogen by the palladium lattice, and PbH represents one stage, one particular stage, along that line.

Then, of course, I might mention also the fact of the carbon in iron martinsite.

It is, therefore, hardly a fair criticism, possibly, that this sort of chemistry is irrational and not very reputable. The new field of the study of distorted structures and solid solutions, where we are dealing with compounds or with combinations that are not in the simple ratios of whole numbers, as we have so

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long come to expect from the laws of John Dalton. All this is very new and requires very much work. We are interesting ourselves as much as we can, and from every experimental form of view, as to what does happen in distortion when we do have these broader line cases, and in such a system as that, as this, it is hardly necessary, it seems to me, to assign a definite valence value of one to lead, in the sense that lead would lose one of its outer electrons, to something else and have existing a single positive.

There are lots of things that are happening that chemists haven't thought could be possible, and would be in, designated in years gone by as not very reputable chemistry. I have in mind the experiments at Western Reserve, which I think have been definitely proved independently by others—the rare gases of the atmosphere form compounds of helium, argon, and so forth. That's been one of the chemists' great biblical statements—that these rare gases should not and must not combine with anything because their outer valences show they are saturated. There is no quarrel here at all with the great history of chemistry, not in any sense at all. There's no attempt in any of this thought to overthrow the well-established principles of chemistry. I wouldn't for a moment sit here or anywhere else and, knowingly and willingly, do such a thing as that, but I do say that chemistry is progressing, it is moving, it is changing. Some of our concepts of long ago, aged concepts, are changing.

Another example, of course, is the fact that a nucleus of atoms can be burst all to pieces—one atom changed to another. That would have been rank heresy a few years ago.

And so, in my thought, in opposing this as an interpretation of the investigations which we have

made—they are not complete by means, by any means—it has been with no thought of doing something irrational but we have to take into question a newer field which has been opened only by newer, precise methods of investigation and measurement, dealing with these distortions and with the peculiar conditions of adsorption and absorption and solid solutions and things of that kind. Single chemical compounds may sometimes do curious things, things not previously suspected, and it is on this basis that the interpretation of a series of lower oxides of lead has been submitted.

I have nothing to present, no comparable measurements to present against, or to compare with many of those that have been presented. I only wish I did have, but I feel it has not been demonstrated that chemical analysis could or could not, or could actually and definitely disprove this. As far as I can see, there has been no proof that chemical analysis could do that. I have not been able to do it although maybe somebody can. Density measurements, amalgamation experiments, heats of reaction, and things of that sort, have been presented. No doubt, I haven't any doubt that if we had made measurements that many very similar results would have been obtained to compare with those already submitted.

And, again, I feel that taking, that taking, these possibilities, these various types of measurements, I didn't feel that the substance containing so small an amount of a variable composition, the density measurement, I didn't feel it could mean very much. The amalgamation experiments presented by Dr. Ullmann were certainly very beautiful experiments, and the Lehigh laboratory is to be congratulated on working out a technique of that kind, I think. I think, as an

addition to our chemical literature, that that will be much appreciated. But there, again, it would be impossible, on the basis of that amalgamation experiment, to tell whether variable substances were amalgamated or were not amalgamated, or what did happen to it. And the same thing would apply to heats of reaction. There is no question but what the calorimetric measurements can be made with extreme accuracy. The principles established by Theodore W. Richards and many others constitute a splendid page in the history of physical chemistry. But again, here again, has come along some very interesting new information which was presented here yesterday. It was mentioned here yesterday as having to do with the possibilities that, under certain conditions of preparation, certain oxides, not all of them were investigated, by any means—there's only a few so far—could have very, very different energy values. In other words, zinc oxide can be prepared, which is an extremely active catalyst, in the preparation of methyl, and so on. Yet the same zinc oxide can be prepared and treated a little bit differently, at a higher temperature, and it has no catalytic activity at all. The fields of chemistry and industry mystify people very much indeed.

Calorimetric measurements were made of heats of reaction, and we found marked differences in the active and inactive—more or less, inactive—depending upon the method of preparation, that the activity of the particular substance—it is chemically active, it has chemical activity, it has catalytic activity—and its catalytic activity was tied up intimately in with the higher basis of potential energy contained, potential energy content of some kind. The only possible consideration that has been reached so far by Friche and

his co-workers is, under certain conditions, zinc oxide, beryllium oxide, lead oxide, and PbO—only very partial experiments, I guess, have been made on those—might actually exist, in which the planes were enough distorted so that the atoms were while the balance of the energy of zinc was normal or perfect.

Now, where that enters into a problem of this kind, it is very hard to say. Only ferric oxide can be made five thousand calories higher than another—no other preparation at a higher temperature—and whether that enters into this situation yet, we don't know yet. It simply raises the question of whether the heat of reaction, by itself, would it be adequate, clearly distinct—a system, very largely, of beautiful crystalline lead, beautiful crystalline red tetragonal PbO. There isn't any quarrel about that at all.

Now, of course, we might comment at a great deal of length but it isn't necessary to do that upon the peculiar history of the last hundred years.

MR. MORRIS: I wonder if that would help us, if your Honor please?

THE COURT: I think I will let the witness proceed.

MR. MORRIS: All right.

THE WITNESS: I don't mean in any sense to enter into that situation, because it has been just simply an interesting history already presented with all sorts of papers, all sorts of experiments that have been made dealing with the oxide of lead, this lower oxide of lead. And, it just seems a curious phenomena—to me, at least—that, to this day, you cannot, I don't think anyone can, adequately explain, either one way or another, some of the results that have been obtained by men who have or have claim claimed the

existence of an absolutely definite compound, Pb_2O, assuming the valence of lead equals one.

There's the paper, a recent paper, by Pascal and Minne, Sorbonne, in Paris, using an independent method of magnetic susceptibility. He very carefully prepared a compound from lead oxalate, and simply finds that the magnetic susceptibility of that particular material simply cannot be made to match the magnetic susceptibility of any synthetic mixtures of Pb and PbO. It can't be made to match any materials.

MR. MORRIS: If your Honor please, the witness is going into an additional reason not given in his opening, this magnetic susceptibility, and we will ask leave to produce some witnesses on that.

THE WITNESS: Well, I will be glad to withdraw that.

THE COURT: I think, possibly, as long as he didn't make the experiments and is only speaking of, generally, what is known as general literature, it might just as well be. I suppose it is all available to me, if I wanted to read it.

THE WITNESS: I will be very glad to withdraw that.

THE COURT: All right. I would be glad if you would—let me ask you this:

By THE COURT:

Q. I would be glad if you would tell me a little more definitely what you think is wrong with Dr. Davey's and Dr. Anderson's experiments because, while they are all—I realize that all of you have enormous respect for one another, I get that idea—but I also get the idea that you think there must be

something wrong with his results because he didn't reach the results that you did. Now, did he have—let me ask you, Dr. Davey, as I understand it, simply did not find a number of lines which you found and he found a few lines—correct me if I am wrong—he found a few lines which corresponded with a flow of your critical lines. Was that his testimony?

A. Well, I think that—

Q. As you understood it?

A. Dr. Davey did not, if I remember right, in any of his experiments, did not find additional lines. Professor Anderson, in some oxalate experiments, found additional lines which he said were due to lead oxalate.

Q. Well, Dr. Davey had a suggestion that they might be carbonate?

A. Yes.

Q. Those lines that he was talking about were a few of the lines which you relied upon to show Pb_2O, weren't they?

A. Yes. That is, he took these data of mine and fitted them; not what he obtained.

Q. Did he—

A. No, he fitted them in what he obtained.

Q. Did he obtain them?

A. Yes.

Q. All right. He didn't obtain any of your Pb_2O lines, then?

A. I don't think he did.

Q. Why don't you think he did?

A. Depending upon—that's just his testimony. As I say, it is impossible to tell what the source of discrepancy is. It may reside, first, either in the technique. He used, of course, throughout, the General Electric type of apparatus.

Q. —and save reading them?

A. Sure.

Q. Then we can read them afterwards, since we are working against time.

MR. WHITCOMB: Of course, we want them read into the record.

MR. MORRIS: I thought we would put them in the same as we did the heat of reaction. All right.

THE COURT: What are they directed to?

MR. WHITCOMB: Detailed differences in answer to the question I just asked on the action of the Tudor mill as he understands it compared with the action—

MR. MORRIS: I have no objection, either way. I thought that they could be put in the same as the heat of reaction.

THE COURT: You mean as part of his testimony?

MR. MORRIS: I mean as part of his testimony.

THE COURT: Yes, all right.

MR. WHITCOMB: It is two or three pages.

THE COURT: Well, just insert it at this point as though he had testified to it.

MR. MORRIS: Perfectly all right.

MR. WHITCOMB: Of course, we wanted the benefit of your Honor's hearing it, but I don't see that that—

THE COURT: Well, I am going to read it.

MR. WHITCOMB: Read it anyway, all right. Counsel for plaintiff offers in evidence—

THE COURT: Just at that point insert those notes, just as though he testified to it.

MR. WHITCOMB: —the five sheets produced by the witness and asks the Clerk to mark the same Plaintiffs' Exhibit number 64.

(Papers entitled Testimony of Dr. Clark re Tudor Mill were marked Plaintiffs' Exhibit number 64.)

THE COURT: Well, you have this really in the form of testimony.

MR. WHITCOMB: Yes.

THE COURT: So it goes right into the record at this point.

MR. WHITCOMB: Yes.

THE COURT: All right, go ahead.

MR. WHITCOMB: It was practically exactly in the form of question and answer.

(A copy of Plaintiff's Exhibit number 64 follows:

"August 26, 1935.
Dr. Clark, Messrs.
Yamaoka, Wood and
Schaffer.

TESTIMONY of Dr. Clark re Tudor Mill

Q. Are you familiar with the so-called Tudor mill as operated in Toronto?

A. I was not present to make an inspection or to see the mill in operation, but I have studied the drawings and talked with those persons whom I understand were present during the operation of the mill.

already indicated, in such an inert atmosphere the balls just tend to polish each other, that is, there is a mutual effect one upon the other, and there is no—no product formed such that it can be discharged from a ball mill, or something of that kind.

Q. So that your position is that what might happen by scratching on a piece of paper would not be indicative of what went on in the mill?

A. Yes.

Q. And that, therefore, your theory of the molecular formation of the lead particles is the correct one, is that right?

A. Yes.

Q. By the way, what is the color of the Prest-O-Lite oxide samples or samples that you have examined made according to the Shimadzu process?

Mr. Morris: Well, I don't know whether it is made according to the Shimadzu process or what departures were made from that, so I would rather not have your conclusion on that.

By Mr. Whitcomb:

Q. Well, state whether or not they are according to your understanding of the patents in suit.

A. According to my understanding the Prest-O-Lite product is made by the Shimadzu process in the Shimadzu mill, and it has a greenish-gray color, tl present mill samples as I have received them.

Q. And how about the product of the USL mills, can you say the same thing or not about them?

A. Yes, same.

Q. Greenish-gray, do you mean by that to convey the idea of a dark gray or a light gray?

A. Well, they are not a dark, dark gray at all, it is a—it is more of a sort of a grayish, brownish, olive

color. It is very hard to describe the intermediate shade or hue.

Q. Were you familiar with the so-called Tudor mill that was operated in Toronto, its construction?

A. I have not seen the mill and I didn't see the test made at Toronto, but I have seen the drawings of the Tudor mill and I have talked with those who were present at that test.

Q. And that Plaintiff's Exhibit 43 represents your idea of how the action takes place as you indicated on your direct-examination?

(Plaintiff's' Exhibit 43 was shown to the witness.)

A. Yes.

By Mr. Whitcomb:

Q. You notice certain additions have been put on the drawing since then, and will you bear those in mind and state whether or not you find differences between the Tudor mill as you understand it and the operation, and the Shimadzu mill of the patents in suit and the process of the Shimadzu patents?

A. I can in no sense qualify as an expert in aero-dynamics or aero-statics or anything of that sort. When this question was asked me some time ago, just purely from a more or less chemical point of view, I attempted to formulate an opinion as well as I could. With your Honor's permission I would like to, for the sake of saving time and for accurate statement, I would like to refer to these notes which I have simply prepared.

By Mr. Morris:

Q. Can you submit the notes as they are,—

A. Yes.

MR. MORRIS: What lattice work structures?

MR. WHITCOMB: Of any kinds.

MR. MORRIS: Oh.

THE COURT: Well, the only thing is, I don't know what the question means, exactly.

MR. WHITCOMB: As compared—show how many of those by any possibility, if any, form in this cuprite type.

THE COURT: All right.

MR. WHITCOMB: That is the thought.

THE WITNSES: Well, I assume you refer to the existence, naturally or synthetically in the history of chemistry of all different crystalline substances. It would be impossible to form an accurate estimate of that. I suppose Beilstein, for example, lists several hundred thousand organic compounds alone. Carbon compounds and crystalline compounds would certainly run into the hundreds of thousands which are known. Not all of them by any means, of course, have been investigated.

By THE COURT:

Q. Does anybody know what proportion of those have the cuprite structure?

A. Well, the percentage must be extremely minute, that is, from the X-ray point of view and so far as we know, Cu_2O and Ag_2O have been definitely assigned to that structure, and the Pb_2O was assigned to that following the work of Ferrari, of course. So far as I know those are the only—only representative of—well-known, at any rate—of this type.

By Mr. Whitcomb:

Q. Well, this morning did you point out why in your opinion the substances you have been investigating and reported as a suboxide of lead could not have been the other substances such as the zinc blend, sphalerite, the sodium chloride, or sodium iodide, or cuprous oxide, and if not, will you do so?

A. Well, it is, of course, only reasonable that in all of the specimens under investigation lead is the element concerned. Certainly there cannot be any of these other things out of a mill, you could not have copper salts or zinc salts or things of that sort when you start with pure lead oxalate, and, of course, the presence of lead can be qualitatively ascertained very easily in these compounds by dissolving and precipitating the lead by some identifying test, either lead chromate or lead sulphate, or you could use the charcoal bead test, make a button of metallic lead, and so on, all the well-known tests for lead, so that I do not think there could possibly be any misunderstanding but that we were dealing with lead compounds.

Q. So that in your opinion eliminates all those four, is that right?

A. Well, it eliminates calcium fluoride and all, yes.

Q. What have you to say about the color of the samples as a distinguishing characteristic or not?

A. Well, I think a great deal of dependence has been put upon color when it is, of course, justified and well-known that the color of any mixture is determined by the fineness of grinding—

Mr. Whitcomb: Pardon me, will you read his answer?

(The answer was repeated by the Reporter.)

to find any evidence of which or any constituents that we might happen to think about which may or may not mean anything.

(Discussion off the record.)

THE COURT: All right. We will take that up after lunch, then. We will resume at 1.30.

(Recess, 12.30 to 1.30 P. M.)

AFTER RECESS.

Present: Counsel as before noted.

GEORGE L. CLARK, recalled.

Direct-examination (Continued).

By MR. WHITCOMB:

Q. Dr. Clark, will you state on the record our position, your position, with respect to the idea of any reversibility, that is, describe it as compared with the dissociation, so as to make that clear on the record.

MR. MORRIS: I assume that is not a departure from our understanding of yesterday.

MR. WHITCOMB: No, I assume not.

MR. MORRIS: Then I wonder if it needs any explanation.

THE COURT: Do you think it does? What is your idea?

MR. WHITCOMB: Well, the point was that, of course, we did not retract in any way from the position that plaintiffs took for the formation of Pb_2O from the lead with the oxygen, and then the dissociation of the Pb_2O. That would not be construed as a reversal.

THE COURT: Well, all right, if he wants to distinguish between dissociation—

MR. MORRIS: Then I have no objection.

THE COURT: That is what he wants to do?

MR. WHITCOMB: Yes.

THE COURT: And the reversibility.

THE WITNESS: Then I simply want—I am sorry that there was some misunderstanding about that, all that I meant was simply this, if we did consider the possibility of a reversible reaction, Pb_2O equals Pb plus PbO, yet would that reaction go completely, or very nearly completely, at any rate, from left to right, that is from the Pb_2O over into lead plus PbO, because of the continuous removal of lead, either by oxidation or by growing into inactive grains, and I just want to make that clear, that the dissociation is what is mean in this case.

By MR. WHITCOMB:

Q. And what happens in connection with dissociation?

A. Well, suboxide of lead dissociates into lead and tetragonal PbO.

Q. Did you point out how many possible crystalline substances there are that might be subject to an investigation in producing these different lattice work structure?

By Mr. Whitcomb:

Q. Is or is not, I mean, I want to know, I thought you lowered your voice—

A. Yes, I say in the past by many people, is what I mean to say, by many people a great deal of dependence has been put upon color to identify a product, but we know perfectly well that color is not a dependable criterion of the constitution of materials, because the color depends upon the fineness of division, subdivision.

That was, of course, well illustrated yesterday where we had the difference between the very palest yellow and the very deep orange-red for PbO, and it is simply that unless we know very, very more facts about any given material, about any given mixture, especially that the denomination or the distinction or characterization of that mixture chemically is not justified upon the basis of just color.

Q. Do I understand you have a definite reason why you can eliminate the lead oxalate from the results you found from the Exide mill samples? If so, will you state that?

A. Well, the synthesis of lead oxalate must be, of course, a very complicated process, presupposing the presence of carbon in considerable amounts, the synthesis of oxalic acid by some process, and I think we can simply eliminate any possibility of that—of the synthesis of lead oxalate in the Exide mill, because I do not think anyone would admit there is any considerable amount of—any more carbon than the minute traces, small amounts, which might be naturally present in the air, and certainly there would not be any for any such synthesis.

Q. In connection with particle size please state what your position is after hearing defendant's witnesses testify with respect to the formation of the

small lead particles by the molecular theory, as you described in your direct-examination.

MR. MORRIS: Is there any departure?

MR. WHITCOMB: I think not, no; no departure.

MR. MORRIS: Well, then, let him just say so.

By MR. WHITCOMB:

Q. State whether or not there is any departure from your position—

A. No.

Q. —in any way. And what have you to say about defendant's witnesses' testimony about particle size in that connection, if anything?

A. Well, the example was shown of rubbing a piece of lead on a piece of paper, which was then examined microscopically and presented as evidence that lead could be produced by an abrasive process. Of course, anyone can draw, obviously, can draw a line of —with a soft piece of lead can draw a line on a piece of paper. Paper is—does have certain abrasive properties. If we may suppose, however, that that paper now is just covered over with lines, coated over with lines completely, so that it is just a solid mass of lines, I would expect that it would be exceedingly difficult, if not impossible, within measurable limits to produce a further measurable abrasion of lead on lead.

In a mill of this kind, of course, what we are really having is one ball writing a mark on another ball, and vice versa, back and forth and back and forth, and we know that in an inert atmosphere, I think both sides have agreed to that, that in an inert atmosphere practically no measurable discharged product is produced. I have seen inside of a mill, and find that there is a considerable—just like a lead mirror covering the inside coating of the mill, and, of course, as we have

Mr. Whitcomb: I think that is one of the points the Court would like to know about. Will you please—

By The Court:

Q. You all used the General Electric first?

A. Yes.

Mr. Whitcomb: And discarded it.

By The Court:

Q. Were you able to get results with it?

A. The films were not clear enough, in my mind, to be able to distinguish one way or the other because of the fogging, the very long time required, and that was the reason.

Q. From your General Electric apparatus results, you would have made the same report that Dr. Davey made?

A. No, I don't think I would, that is, just simply the results were definitely in doubt; that is, you couldn't be sure whether they were faint lines there or not. That's the point.

Q. He was sure they were not?

A. Yes.

Q. All right. Now, can you tell us a little more about what you think the difference in technique—results, I mean—how you got your improved results from your other apparatus?

A. Well, I have tried to indicate—there's that, of course, the continual experimental effort towards getting just as clear and sharp film as we could. I might say that I have just simply let the films themselves, let the films speak for themselves.

By Mr. Whitcomb:

Q. But, Dr. Clark, I don't think the Court appre-

ciates those points nothing like a chemist does, and that's what the Court is inquiring about. I don't think there's—there is no use being modest. Tell what you think about them.

A. I simply feel—I wasn't satisfied with our results or with the technique at all. We had eliminated completely any containing walls of capillary tubes, and things of that kind, so we could use the specimen itself and could use a camera at vacuum, with vacuum, to eliminate any possibility of scattering due to the air. Of course, that also actually improves—I mean, it somewhat decreases the time required—it's not very much, but to some extent. Thus, when we had made that combination, we have produced these films and which I feel, with a very considerable degree of satisfaction, with accuracy, of course, as already has been attested to by Professor Davey.

Whether that's it or not, no one could say, I suppose, unless Professor Davey came to my laboratary and used the same apparatus, to the best of his ability and with such precaution as he thought best.

The other alternative, of course, is that the samples, as studied, actually differed somewhat, that is, either, as Dr. Davey has maintained or suggested, that his might have had something missing which was present in mine. Now, that is all. I think that is all I can say.

By The Court:

Q. It seems to me it would be a great deal, especially, to get an additional substance—it would be a great deal easier to get an additional substance in, or one out? Am I wrong?

A. Well, you have, of course, you have to avoid the possibility of contamination and impurity. On the

other hand, if you have present some unstable substance, why, of course, it can disappear. That's the thought.

Q. What precautions are necessary to prevent the disappearance of an unstable substance such as Pb_2O?

A. Well, the principal thing, of course, is its sensitivity, sensitiveness to elevated temperatures, to the elevated temperatures, under any consideration, and then the ease with which it oxidizes, particularly when a small amount of moisture is present. That's the reason I had these samples put over P_2O_5.

Q. What's that?

A. Phosphorous and oxide.

THE COURT: Well, I guess that's all.

By MR. WHITCOMB:

Q. What about the length of the exposure of Dr. Davey's films as compared with yours?

A. Yes. He testified to many hours, I think twenty-four or forty-eight, or whatever it was, I don't just quite remember. There was the effort here to make comparisons out over as short a time as possible. We would expose some films longer but I present, for comparative purposes, the film exposed just long enough—an hour, that's on the average—to give a good pattern without any undue exposure.

By THE COURT:

Q. Do you think too long an exposure might result in some inaccuracies in the result?

A. Well, there is always that possible. Of course, the X-ray tube heats up considerably and in a closed system, especially, where sets are pushed up close to the cylinder which holds the X-ray tube. Of course, there's the possibility of some temperature rise and, especially, over a long period of time.

By Mr. Whitcomb:

Q. Is it your opinion there that that might have influenced the material in the tube in Dr. Davey's experiment and, possibly, changed the suboxide or some form of suboxide, so that he didn't get in his total results?

A. That's entirely possible because I know that from our own experiences with the same mill under various conditions. We have gotten films perfectly, and perfectly free from these additional lines, perfectly plain and about which there isn't any doubt at all.

By The Court:

Q. How many experiments did you make, that is, how many X-ray analyses did you make?

A. Well, in the course of this whole investigation, of course, as I have said before, we have made nearly, I suppose, five hundred films, dealing with all phases of the subject.

Q. How many analyses of the gray oxide did you make?

A. Why, we made the analyses with the official samples submitted and signed by Dr. Wilson.

Q. But how many times did you "shoot" that?

A. Well, there's been—of course, each one of those—each specimen was divided, really, into three parts and screened and so forth. We made a film of each one of those, and then several incidental films have been made with material exposed to air, of course, and material after being centrifuged, and after standing for some period of time. We made some in the month of September, this year, after the samples had stood all this time—and, oh, the principal proposition is to produce a good film of the samples as they came. These other things were simply to enable us

will therefore be condition by the formation of such water films and therefore the mechanism of the Tudor process should be sensitively conditioned by such factors as humidity. On the other hand if air is introduced as a forced and directed stream and by virtue of its viscuous slip along solid gas innerfaces such directed currents will have a well known sweeping action which dislodges absorbed films of moisture or other protective liquid or gaseous materials. Because of this action therefore the effect of changes in water vapor concentration in the atmospheric air becomes negligible in the operation of the Shimadzu process and under all conditions the normal rapid reaction of absorbing oxygen with the metallic lead takes place with little or no hindrance and thus has an essential constant rate. This freedom from the deleterious effects of relatively minute variables is therefore a distinguishing feature of the Shimadzu process. Whereas, in the Tudor process the essential oxidation process is at the whim of the elements of nature and atmospheric conditions and the reaction zone is subjected to the rules of fugacity in which the tendency is for the air pressure to push out of the drum. Therefore there is a tendency to have an insufficient and variable supply of oxygen at all times thereby subjecting it to deleterious effects from atmospheric conditions and changes. The principle of the Shimadzu mill is exactly the opposite in that instead of the fugacity the air is directed and forced into the drum in such quantities as to overcome such hazards and thus to insure a smooth, continuous and uniform operation at all times.

Q. Is it possible to operate the Tudor mill in a satisfactory condition as the Shimadzu.

A. No matter what the combination of variables as regards temperature, size of lead pieces, rate of rotation, dimensions of the drum or other mechanical features, the Tudor mill without the essential condition present in the Shimadzu process of a directed and forced current of air cannot and does not give a satisfactory performance as measured by the production of a commercial product.")

By Mr. Whitcomb:

Q. Then subsequent to your discussion of those questions about the action of the air I would like to ask you what in your opinion would be the results if you attempted to take the mill as it is there, as Defendants had it in 1915 and in 1916, according to their testimony, and in 1917, and yet in 1920 used the type of mill with the increased force draft, with the air going into the inside drum, and state what would occur if you attempted to force the draft into the mill as shown on this Exhibit 43. What would be encountered in your opinion?

A. Well, I think that would constitute a new invention.

Q. Upon what do you base that answer?

A. Of course, that is— part of my answer, part will depend or goes back to the analysis which I have made in these notes, but the—

Q. That is, this Exhibit 64?

A. Yes.

Q. That we just introduced.

A. But the production change, the change from a process producing, as I understand it, only a limited amount of product, very limited amount of product, to

one in which there is certainly a commercial utility and value.

Q. By the way, in the Prest-O-Lite Mill or in the U. S. L. Mill do you know about what the production per hour is, from your examinations of those mills from time to time?

A. I have seen those mills and I have seen them in the course of an hour fill a drum of four hundred pounds and another one half full or so, or maybe a little over; averaged somewhere between six and seven hundred pounds per hour.

Q. And how does the size of the drum compare with the size of the drum as illustrated in the alleged Tudor prior use, as shown in Plaintiffs' Exhibit 43? The Prest-O-Lite is a little larger drum, is it?

A. It is longer, as I understand it,—

Q. Do you know how much?

A. —but the same diameter.

Q. Do you know how long?

A. Five feet long, and five feet in diameter.

Q. Then will you proceed with your answer to the other question, before I interrupted you?

A. Will you read the question, please?

Q. As to why you thought it would constitute a patentable invention.

A. Well, simply because a production of fifty or sixty pounds an hour, which goes up to seven hundred or six hundred, between six and seven hundred pounds an hour, certainly represents the difference between a not very satisfactory, certainly, commercial process and one that is, and, in other words, an increase in production of ten-fold by any process added to this set-up which would increase that production ten-fold would seem to me to constitute a very valuable additional feature, which is an invention.

Q. To put it another way, Dr. Clark, assume the

operation as in the alleged Tudor prior use shown in Plaintiffs' Exhibit 43, and assume everything just as it was there according to the testimony, and you put on a fan and immediately substantially increased the passage of air, leaving other things equal, what would that show, what would that result in, according to your understanding?

A. Well, other things being equal it would result in—as is known—in an increase of production, very greatly increased production of product.

Q. Well, but wouldn't the air have a cooling effect on the same load at the same speed?

A. An increased blast of air in a combination like this, other things being equal, with the same load and the same speed, would, of course, tend to produce a cooling effect.

Q. Then what about the passage of the material? The air takes the material in one direction in the Tudor construction, and in that the discharge is in the opposite direction, is that right?

A. Yes.

Q. If you increased the draft of air in that arrangement, what would happen?

A. Fine particles of material, of course, would be carried in the air as a carrier up through the stack.

Q. Why would an engineer have to reorganize the structure, then, under this increased production. Will you please explain?

A. Why, he would lose his—lose his product, of course, under the construction like this, and, of course, the regulation would have to be made of charge, amount of air, rate of rotation, and method of discharge, so that an optimum, or, at least, a very highly satisfactory condition of oxidation is made possible and the product removed and collected.

Q. And before the change had been made to this great increase in production and the engineer at-

Q. Do you find differences between the defendant's Tudor mill and the Shimadzu process?

A. Yes.

Q. Point out briefly what those differences are.

A. In answering this question I will summarize first the essential features of the Shimadzu process as I understand them from a study of the subject. In a horizontally revolving cylinder a charge of metallic lead pieces is subjected to the oxidizing effect of a blast or forced current of atmospheric air; by the combined chemical action of oxidation and the abrading action of oxidation and the abrading action of the pieces of lead rubbing against one another a fine powder is produced by attrition which is removed from the mill through the carrying agency of the forced current of air. The product so obtained on exit from the mill is collected in suitable manner in order to obtain a satisfactory commercial yield. The Shimadzu process depends essentially upon the action of atmospheric air in excess quantity since the oxygen in the air is necessary for the reaction with metallic lead on the surfaces of the lead pieces forming the charge in the revolving drum. In order that a powder may be formed by attrition, it is essential that an oxidized layer be formed on the surfaces of these pieces this said layer being characterized by brittleness and the possibility of detachment as the pieces come into contact with each other. In this forced current of air the supply of oxygen is being continually renewed so that the concentration of oxygen absorbed on the lead surfaces is kept essentially constant and at no time during the course of operation of the mill or in any zone of the charge is there im-

poverishment of oxygen with resultant change in rates of absorption of oxygen on to the surfaces, chemical reaction with the lead and diffusion of oxygen through the outer oxidized layer into underlying layers of unreacted lead in the individual pieces. This is the first and chemically essential function of the introduction into the mill of a positive blast or continuous forced current of atmospheric air containing oxygen. This forced current of air has at least two other functions. The second is, of course, the effect which it has on the temperature, not only of the gaseous atmosphere in the mill but also the charge of the solid reacting material since all of the reactions which are proceeding in the mill have definite and marked temperature coefficients. The effect of a continuous forced current of air at constant temperature in maintaining constant temperature gradient as well as in supplying a constant supply of oxygen is an essential function. The third function is to afford a constant method of removing the powder from the interior of the mill in which the forced current of air acts simply as a carrier. The directed and forced current of air which is an essential attribute of the Shimadzu process distinguishes clearly and definitely this process from that in which the Tudor mill is involved. In the Tudor process the reactions proceed in the presence of atmospheric air at ordinary pressures and this atmospheric air is introduced into the mill merely by the normal influx through the various openings in the mill from the outside air of the room in which the mill operates. Thus, the only possibility for the replenishment of air in the interior of the mill which is being exhausted of oxygen as a result of chemical oxidation processes is

by this natural diffusion of ordinary atmospheric air from the outside. This ingress, however, will be opposed by the following tendency of the air within the drum. As a result of the oxidation and attrition process, the temperature rises not only in the solid mass but also in the air which is not being moved or changed in any way by a directed or forced current. The given volume of air in the drum by operation of the well known gas laws will therefore exert or tend to exert a higher pressure because of this elevated temperature of the gaseous molecules. The escaping tendency or fugacity of these gaseous molecules on the interior of the drum will therefore be greater than that which is possessed by the gaseous molecules in the exterior environmental air. The tendency of the gas within the drum therefore to escape outwardly into the outer environment is actually unfavorable to the ingress of a renewed supply of atmospheric air from the outer environment of the mill. This increased fugacity due to increased pressure, of course, is balanced in whole or in part by the fact that oxygen is being effectively removed through its combination with metallic lead thus lowering the partial pressure of gaseous oxygen. Therefore the only possibility of any successful replenishment of oxygen will be that the partial pressure of gaseous oxygen is sufficiently reduced so that the total outer atmospheric pressure overcomes the greater thermodynamic fugacity of the inner gas at the higher temperature. That these processes are operative and that a positively renewed and constant supply of oxygen is essential for a successful commercial production of material is adequately demonstrated by the very low yields admittedly obtained in the operation of the Tudor

mill simply because there is an insufficient supply of oxygen to enable a continuous process of oxidation and attrition to proceed. The directed and forced current of air has a further important, though little realized, function. Experimental data which have been obtained by various workers and which are in excellent agreement prove that the Shimadzu process operates successfully independently of such factors as the humidity or purity of the air utilized in the process. Selective absorption from a mixed gaseous atmosphere upon the surfaces of solid bodies is a phenomenon well established and definitely known to all chemists. Thus, in order that any oxidation process shall proceed, it is first essential that oxygen molecules shall be absorbed upon a reactive surface as an absorbed film. This physical absorption process is then followed by the chemical combination. It is at once apparent that a large supply with constant oxygen concentration or partial pressure is necessary if this first absorption process proceeds smoothly and uniformly in all parts of the mill and continuously in time. There will also be absorbed not only nitrogen molecules which are entirely chemically inactive but also other species of molecules present in the gaseous atmosphere such as water vapor in proportion to the partial pressure of those species. In a class of atmosphere such as the character of the Tudor process relative to the directed, forced and turbulent atmosphere which is an essential attribute of the Shimadzu process, absorbed films of considerable thickness may be built up and there is no provision by which water films formed by the absorption of water vapor molecules can be controlled or eliminated. The type of reaction as well as the rate

tempted to increase the draft would that tend him to go further in that direction, or would he find that he got more production by decreasing the draft? You will recall one of the witnesses stated that when they put on the stack they decreased the air inlet.

A. Well, upon the basis of my analysis where a continually replenished supply of oxygen is so desirable in any of these processes, why, that would seem to be going in just the wrong direction, that is, to close the amount of air down.

Q. And all these considerations enter into your calculations expressed as to why you thought that would be a patentable change to modify this Tudor construction to get the results and operation of the Shimadzu patent in suit, is that right?

A. Well, to the best of my ability, analyzing the correlation or the reaction between lead and air and oxygen, why, I would say yes.

Q. Some of the prior art patents refer to the use of water in the mixture. Please state what in your opinion that would—what effect that would have in mills of this type.

A. Well, in the presence of water I think we might have an altogether different series of reactions. The water would tend to condition the temperature, of course, and you have hydration of the products, formation of hydrates, and all that sort of thing, and it seems to me would simply eliminate any close comparison that could possibly be made between either process or product.

Mr. Whitcomb: Direct-examination closed.

Cross-examination.

By Mr. Morris:

Q. If you have a perforated drum the Shimadzu process cannot be carried out?

A. No, it can be carried out.

Q. It can be carried out? Then what would be what you have designated as an invention over the Tudor or German mill if you used a perforated drum?

By Mr. Whitcomb:

Q. Would you like to see the other charts, the patents?

Mr. Morris: I would just rather he would answer that, if you don't mind, Mr. Whitcomb.

Mr. Whitcomb: Well, I think he should consider the patents.

The Court: Well, no, but, now, he doesn't need any help in this thing, better let him handle it himself. If he wants anything he can ask for it.

The Witness: Did you finish your question?

Mr. Morris: Yes, I did, Doctor.

The Witness: Oh, I beg your pardon. Will you read it?

(The question was repeated by the reporter, as follows:

"Q. Then what would be what you have designated as an invention over the Tudor or German mill if you used a perforated drum?")

Mr. Morris: The perforated drum of Shimadzu.

The Witness: Well, the invention is a forced draft of air presenting to the lead a continually replenished supply of oxygen.

By Mr. Morris:

Q. In what quantity?

A. Well, in large excess..

Q. A large excess quantity. Can you find that set forth in any Shimadzu patent in suit?

A. Only in the words "gust" and "forced current",—

Q. Well, you can have gusts and forced currents without large excess, can't you, particularly if your mill is large enough?

A. You say you can have?

Q. Yes, can't you, you can have a gust—

A. Yes.

Q. —and you can have forced draft without any excess volume?

A. Why, yes, of course, you can always, that is, depending on a difference, a pressure differential, you can have—

Q. So that, can you put your hand on anything in any of the Shimadzu patents which tells you you must use an excess supply of air? I am speaking now of the perforated, rotatable drum. We will come to the other in a moment.

A. Well, I would have to refresh my memory whether the words "air in excess" are used there or not, is mentioned there or not. I don't remember.

Q. I don't remember, and to save time we will have to let the patents speak for themselves.

Let's make two assumptions, then, first, let us make this assumption, that there is nothing in any of these patents to show that there is any excess of air called for in any of these patents. Will you then put your finger on the invention, as you call it, which would be required in using the Shimadzu Mill, perforated mill and process, over that of the old German Tudor Mill, when that mill is used with a stack, as testified to by Mr. Kershaw, Mr. Reinhardt, Mr. Hoelzle, and possibly some others?

A. Personally, from my point of view, at least, any difference must reside in the boundary line between a more or less static volume of air heated, which gives, of course to that—to that volume of air a certain escaping tendency, as we might call it.

Q. Did you ever use a fireplace?

A. Yes.

Q. Did you ever have smoke go up the chimney?

A. Certainly.

Q. That means what to you?

A. Well, there is no question of a draft being created by a chimney.

Q. Is there any question in your mind at all that there was a draft and changing units of air volume in the Tudor Mill or German mill, whichever you want to call it, as used by the Electric Storage Battery in Philadelphia in 1916 and '18, and in Cleveland by the Willard Company in 1920?

A. Of course, the answer to that is conditioned entirely, it seems to me, upon the presence or absence of a stack.

Q. Well, I am using the stack, I am using the stack, and I am using a forty-five inch stack on this mill, which is approximately thirty inches—the German mill in Philadelphia is approximately thirty-six inches long and sixty inches in diameter, and had 1482 one-eighth inch holes, such holes being one-eighth inch in diamet —it may be 1480, so you can take both 1480 and 1482 into your calculation—and I am advised, and if you can check that, the calculation is that these fourteen hundred and some holes, eighty-odd holes, are equivalent to a stack, to a single opening approximately four and a half inches in diameter, and if you have any doubt about that we will check it.

A. Well, there can be no question, of course, about the production of convection currents in a case like that. I don't see how anybody can—

Q. Then there would be a passage of air, depending upon the draft of your stack and the heating conditions and the extent of openings and all of that, would there, Dr. Clark?

A. There will be a passage of air toward the stack, yes.

Q. Then let's come back to our former question, do you under those circumstances see any invention made by Shimadzu in his process, when we use the German mill with the stack, where the stack has a damper, where the flow may be controlled and the intake of air down the discharge chute likewise has an opening and a closing member, whereby the size of those two openings may be adjusted to suit the conditions prevailing at the time of the use of the mill?

A. Well, it seems to me the question hangs, depends entirely upon the definition or the shading of meaning that is given to currents of air, forced drafts, forced currents, and things of that kind.

Q. Well, now, you are using, you are using the words,—

A. Yes, sir.

Q. —I am only asking questions. Won't you give such meaning to them as you like, and then put your finger for me, please, on the invention which I have inquired about specifically,—

Mr. Schaffer: If Your Honor please,—

By Mr. Morris:

Q. —the so-called invention?

Mr. Schaffer: —this is largely repetition of what has already been answered in the written questions and answers that have been introduced, and unfortunately they have not been read, but largely these questions—

THE COURT: Well, I know, but it is directly, it is directly apposite to the question Mr. Whitcomb asked him, absolutely directly on it. If it is repetition it was opened up by counsel for the Plaintiff.

You did start to answer one question that Judge Morris cut in half—

MR. MORRIS: I didn't realize it.

THE COURT: —with a question of his. You started to say, and I think it comes back to it now, and I wanted to just call attention to it, you started to say there was a difference between the static body of air and something, and then Judge Morris asked another question and you have not finished your answer. I was just wondering what you were going to say.

MR. MORRIS: I would be obliged for you to go back to that, because I recall now I did unintentionally interrupt you, by putting a stack on, to call to your attention it was not a static body of air.

THE COURT: You go back to that question, Mr. Rodebaugh, if you can find it.

THE WITNESS: Well, if I can just explain a little bit what I mean there, if we can think of a more or less static body of air present in a given volume, which has been heated up, that it is in contact with heated materials and heated up, then, of course, we know that in accordance with the well-known gas laws that there is a certain fugacity, let us say, of the air molecules in such a system. Of course, that is being counteracted in part or in whole by removal of oxygen, that is, the partial of pressure of oxygen decreased by com-

collecting, removing the product by the air and collecting it.

Q. Now, they are removing the product by the air that goes through, and all of the product in that way?

A. All that I have ever seen, yes.

Q. It is not a perforated mill?

A. No.

Q. It does not operate at all on the principle of the Hardinge type, where it is, the function of the mill itself is to pour that, force the finer stuff out of the discharge opening?

A. The material which comes out of the exhaust is carried by the air as a current.

Q. That is the only way the air is used as the medium or vehicle for removing of the stuff from the mill, and none is removed in any other way?

A. So far as I know, yes.

Q. All right, let's pass that. How long did it take you to make your centrifugal samples, Dr. Clark, of the gray oxide?

A. About two days of centrifuging and preparing.

Q. So that the samples of the gray oxide that you used were in the mill two days?

A. No, that was the total time required for the preparation of the samples.

Q. That was the total. Then from the time you started you were exposing your particles of lead dust, let's call it, in your centrifuge how long?

A. Each run was a minute and—minute and a half, that is, each successive run, one and half minutes.

Q. Each run was a minute and a half?

A. Yes.

Q. So during that time your material was subjected to the action of what?

A. That was the time it was—that a given volume,

a small volume, was actually in the centrifugal chamber.

Q. I am sorry, but I didn't know that you had finished your answer. Will you give me your answer again?

A. That was the time that the given volume of the dispersed material was subjected to the fifty thousand R. P. M. revolution in the, in the—

Q. In the machine?

A. —super-centrifuge.

Q. All right. All right, now, I want to follow that process with a little care, if you will, because I have not been able quite to get it. What do you call a given volume, how much?

A. Well, it is—it is something between one-half and a teacupful, is the chamber—

Q. Well, approximately the volume, the amount you could put in that paper cup—

A. Yes.

Q. —that you have in your hand?

A. Just about.

Q. That is poured into a liquid, if I understand the process; and that liquid is what?

A. That liquid is a purified hydrocarbon.

Q. Isn't there a step ahead of that? The impression I got, Dr. Clark, was that you poured or deposited the lead dust from the Dr. Wilson's samples —I am right so far, am I not?

A. Yes.

Q. —into a liquid so that you could deposit this liquid into the machine?

A. That is right.

Q. The liquid carrying within it the particles from Dr. Wilson's samples?

A. That is right.

bination with the metallic lead, but unless there were such, unless there is just exactly such a ballance it is reasonable, perfectly reasonable to assume that air will be pushed out of such a drum under any—in any temperature differential, and, as a matter of fact, overcoming the natural ingress of air through any other particular openings.

Well, now, the whole matter hinges on how much can a stack and movement of air in the environment, how much can that affect the opposing tendency of this more or less cushion type of air, warmer air, and which is obeying the gas laws, and it is just—the final result would simply depend upon a balance, that is, whether oxygen is being removed, its partial pressure decreased enough so that the total inner pressure may be overcome actually by the passage of air around outside, around through the holes or around the holes—around the drum, as aided by, of course, a stack. Now, you have a very delicate range, undoubtedly, in there.

By Mr. Morris:

Q. Are you talking now about a difference in principle, or a difference in degree? In answering that question I would ask you to bear in mind and advise me as to whether a stack properly functioning is not in effect a suction means in its function and operation.

A. Why, I think it is, a stack properly designed, certainly.

Q. Then your answer to the other question is what that you have been speaking about, a difference in degree and not a difference in principle?

A. I don't think I should say that, because we grant a current of air around the outside shell with that stack, but what happens in the oxidation process

and actually inside of the mill will certainly depend upon this, the temperature, the operation of these gas laws, removal of oxygen, and so on.

Q. Doesn't it in the Shimadzu process?

A. Yes.

Q. All right, then, do you find any difference in principle there?

A. In the Shimadzu process, of course, a supply of—that is the supply of air, the supply of air is—whether by suction or by direct pressure, is passing right over, as I understand it, the charge in the furnace.

Q. Then with the suction of the stack present and the heating condition in the rotating, perforated drum mill of Shimadzu do you mean to tell me there would be nothing passing through those 1482 holes, and that no air would pass through the rotating drum in the old Tudor Mill, German Mill?

A. Well, air can pass through the—in the Shimadzu Mill, there isn't any question.

Q. Now,—

A. But I say whether or not air passes in this mill—

Q. That is right, that is what I am asking you.

Mr. Whitcomb: Well, let him answer, then.

Mr. Morris: I am asking him to answer this, and that is what—

Mr. Whitcomb: I know, but you interrupted him, Judge.

Mr. Morris: Don't let me do that.

Mr. Whitcomb: We have had that a couple times.

Mr. Morris: What?

MR. WHITCOMB: Interruptions.

MR. MORRIS: I am sorry.

By MR. MORRIS:

Q. Proceed, will you, Dr. Clark, and don't let me interrupt you. If I break in on any answer before you are through, please tell me,—

A. That is all right.

Q. —because I may be guilty of it at any time unintentionally.

A. The picture I have is in this inside volume of air, which is under even such conditions as these likely to have more or less static properties, and I have simply tried to portray what might be easily a possibility, that the air in that drum would tend to push out.

Q. May I ask a question now?

A. Yes.

Q. All right, then I am trying to get whether you are dealing with a question of getting air into the drum for oxidation purposes or you are dealing with some relative volume of air in the drum of the German mill, perforated drum of the German mill, and the perforated drum of the Shimadzu mill. Can you help me on that?

A. Well, in this mill I am speaking of the volume of air inside that is in with the charge itself.

Q. The German mill?

A. In the German mill, yes.

Q. All right.

A. And in the Shimadzu mill I am dealing also with, of course, the volume of air inside of the drum, in which is introduced by—directly, a supply of air right into the drum, as I understand it.

Q. Yes, now, how much, how much, in the Shim

adzu mill, and how much in the German mill, relatively speaking?

A. Well, of course, we have just spoken in that connection with the Shimadzu mill, we can judge only by those terms which I have used before, that is, drafts, forced currents.

Q. All right.

A. Enough so that a product could be removed.

Q. So that a product could be removed?

A. Conveniently, yes.

Q. That is, you are getting into the Shimadzu mill a sufficient amount of air to carry out the product?

A. So that it will be—to use the air so it will be convenient to use that air to remove the product.

Q. Remove it through the perforations, or otherwise?

A. Remove it through any—through the end or another opening, I don't know as to that.

Q. Now, in a stack four to five inch stack, that was placed on the German mill in Philadelphia and Cleveland where would you find any differential in pressure from there to the receptacle for the finished product?

A. First, the air enters the bottom, supposedly, at atmospheric pressure, the top of the stack at atmospheric pressure, for the conduction of the air current as shown any differential, any pressure at constant volume would be simply between two heated—between a heated and relatively unheated zones in the mill. Obviously, the higher the temperature at constant volume the higher the pressure will be.

Q. Now, I don't quite understand that, Dr. Clark, but let's see if we can. You mean, do you or not mean to tell me that there will or will not be a differential in pressure surrounding the drum caused by the heat and the stack and no differential of pressure inside the drum, the rotatable perforated drum?

A. Well, now, I was referring to differential in pressure between the inside of the drum and any cooler passageway outside the drum.

Q. But do you mean—I don't want to stay on this longer, because time is passing,—

A. Yes.

Q. —but do I understand you to mean that those 1482 holes do not admit currents of air into the rotating, perforated drum?

A. There is a tendency—

Q. Only a tendency and not an actuality?

A. Well, I didn't finish my question—there is a tendency, certainly, unless there is a rapid removal, or, I mean an actual, factual removal of air from the inside of the drum, for that air to be tending to expand, push out, and what sort of a balance you have, that is, how much that will prevent or overbalance ingress through the holes from the outside cooler air—

Q. Then how long will it so expand?

MR. WHITCOMB: He didn't finish.

MR. MORRIS: Pardon me.

MR. WHITCOMB: He didn't finish the question.

THE COURT: He surely did not. He said how much that will counterbalance—

MR. MORRIS: I am sorry, go ahead.

THE WITNESS: —will depend upon these factors that you have been speaking of, that is, how much difference in temperature, whether there is a possibility of entrance of air in any other way, which apparently there is not, that is, to the inside of the drum, how much covered up the holes are with lead, and so on. Of course, the main point there is that a temperature differential

in a more or less quiet body of air might be easily sufficient under the conditions of operation to effectually back out any air coming in through the holes, perforated holes.

By Mr. Morris:

Q. Under our theory how long would it take to create a vacuum in the rotating perforated drum?

A. Well, a vacuum, of course, could never be created.

Q. Why not?

A. You have nitrogen present.

Q. Oh, no, I am speaking about the operation of the German mill in Philadelphia.

A. A vacuum created inside the drum, you mean?

Q. That is right, or do the molecules of air stay in an antagonistic position in battle array forever against any incoming molecules of air from the circulating current surrounding the drum?

A. Well, of course, that is true only so long as there is enough temperature difference, and, of course, I am—it is perfectly definite, perfectly fair to say that the lowering of partial pressure of oxygen is also a matter which is assisting or helping in the battle of the incoming molecule. There is no doubt about that.

Q. So that you really do get a current through those holes into the drum, don't you, Dr. Clark?

A. You could under some conditions, yes, but not all.

Q. Well, under the conditions of operation that you have heard of the German mill you do get it, don't you?

A. Well, I don't know.

Q. All right, but if you had fans on the stack to draw the air through, or on the bottom to force it through you might, might then get some into the drum, mightn't you?

THE COURT: Yes.

MR. MORRIS: —because I can put them together later, for whatever value they have or do not have.

By MR. MORRIS:

Q. Suppose you had installed fans on the stack to increase to some extent the current of air that was drawn through the discharge outlet and passed out the stack, would there then be any difference between the German mill and the perforated drum Shimadzu mill in operation, or the method of manufacturing powder therein or thereby.

A. Well, the difference it seems to me would be this, that as I understand it, an air—that is, this fan or current of air produced by a fan in the Shimadzu mill is introduced right in, right into the drum, and of sufficient strength and quantity so that it is convenient to remove any product as a result of oxidation and abrasion, and so on. Now, I don't know what—I don't know how you could predict, I would not know how to predict what would happen in the sense of ventilation or temperature control or effect upon the inside of the drum if a fan were put in the stack. Certainly it would undoubtedly increase the current of air around the outside.

Q. Well, the instant you increase the current of air on the outside does that not have a direct effect upon the currents of air inside the mill?

A. Well, it must, it must have an effect, yes.

Q. You say what?

THE COURT: "It must have an effect."

THE WITNESS: It must have an effect.

MR. MORRIS: Very well.

By Mr. Morris:

Q. Now, are you being exactly fair, Dr. Clark, do you think, in comparing the present-day Prest-O-Lite process and the USL process and mills in the amount of their production with the small Tudor German mill used by the defendant in Philadelphia in 1916 and 1918, and by Willard in 1920?

A. Well, I didn't know that there was any—

Q. Well,—

A. —element of unfairness. I was simply quoting what I know.

Q. Well, isn't there a difference in size in those mills?

A. In the length there certainly is.

Q. There is a difference in the potential load, isn't there, possible load?

A. Yes, in the total amount of lead added.

Q. There is a difference in the actual load of those mills?

A. As I understand it, they use four thousand pounds, or something like that.

Q. Do they air cool entirely?

A. So far as I know they do, yes.

Q. Well, do you know?

A. Well, I am only—the mill that I have seen simply rotates in an open room, yes.

Q. That is, you mean to say you don't know whether they air cool or water cool?

A. No, I don't.

Q. Then you don't know whether they are operating under even the conditions specified in the Shimadzu patents, then, do you?

A. Well, they certainly are operating with a rotating drum, Shimadzu drum, with a charge of lead in it, and are introducing forced currents of air, and are

Q. Now, so the liquid into which these particles were first deposited was the purified hydrocarbon?

A. Yes.

Q. Hydrocarbon contains what chemical elements?

A. Carbon, hydrogen.

Q. Carbon and hydrogen. Now, then, it took that paper cupful of lead dust a minute and a half to be discharged from the centrifuge?

A. That is right.

Q. And then it never went back?

A. It was repeated—of course, this was a—I don't mean to infer that we had a batch process, in a sense, under an atmosphere of nitrogen this dispersed phase was introduced into the chamber, this entrance was from the bottom, and then the super-centrifuge operated by the turbine proceeded. Now, there are two ways you could do that, you could super-centrifuge a given volume, or you can make a continuous process.

Q. Let us assume that you can do it various ways,—

A. Yes.

Q. —but won't you just tell me the way that you did it, so that we can all get away?

A. Yes.

Q. All right.

A. First, a considerable volume of this material was run through continuously from the bottom. The liquid comes out the top. That is collected. That was run through by Dr. Bradley I think possibly three or four times that way.

Then he took individual, simply took individual bits, that is, individual volumes and subjected each one of those to a minute and a half. Now, of course, on the walls of the chamber was the solid phase that was thrown out.

Q. I understand. This stuff that you have labeled

Pb_2O lines on your films was analogous to the cream in the milk separator, as I understand it, cream separator?

A. Well, the finest fraction, of course, is that which does not settle, which is not thrown out by the centrifuge at all.

Q. Yes.

A. That is the skim milk, I suppose.

Q. So that there are three classifications in the centrifuge?

A. Yes.

Q. The heavy on the outside, that which approaches colloidal, I suppose, which stays on top of the medium, and then that which settles in the middle?

A. That is right.

Q. All right. Well, now, what would be the approximate length of time that you would say that this sample that you have given us in the test tube here, and enclosed in an outer test tube was in the mill altogether, I mean, the centrifuge?

A. Well, that was in the mill possibly, let's see—not more than six minutes altogether, probably.

Q. Not more than six minutes. Now, into what was it discharged when it came out of the mill?

A. It was run—the exit pipe runs into a bottle, suitable container, which, of course, was kept from oxidizing by having nitrogen flow into it, flow into it.

Q. Well, the liquid containing—the liquid which is acting as the vehicle for carrying this product in question continued to act as a vehicle until it was deposited in the bottle?

A. That is right.

Q. Then what occurred, Dr. Clark?

A. The liquid was then removed by—in vacuum at low temperature, and the deposit—

Q. Now, were all these samples immediately removed from the liquid, or not?

A. Yes.

Q. Then when Mr. Kershaw stated in 1917 that, in his Exhibit 81, dealing with the product, and dealing with the rate produced, under his subdivision (g), with the room temperature and ventilation that "Control the character of the product as far as possible by the external and internal ventilation systems, installing fans if necessary"—

MR. WHITCOMB: If Your Honor please, now, that has no place, we want to object, that is a written document, that is not what happened, they did not have it in the mill, now, that is a point of patent law, that is inadmissible, because it was not published.

THE COURT: Well, of course, in the first place, the question has not been asked as yet. I don't know what he is going to ask about it. He said when Mr. Kershaw said—

MR. MORRIS: Yes, if I may give the thought, in answer, I am going to ask if that would not meet all his objections, but may I point out this, I am not using this document as a publication.

THE COURT: Oh, I understand that. Now, just a minute, will you ask the question,—

MR. MORRIS: Yes.

THE COURT: —and then don't answer the question until I rule.

MR. MORRIS: Will you read what I did say, Mr. Rodebaugh, please?

THE COURT: As I understand it, this hasn't anything to do with patent law, this is merely a question of cross-examining this witness as to his conclusions. Go ahead, read the question.

(The question was repeated by the Reporter, as follows:

"Q. Then when Mr. Kershaw stated in 1917 that, in his Exhibit 81, dealing with the product, and dealing with the rate produced—")

MR. MORRIS: I withdraw that question and put it this way.

By MR. MORRIS:

Q. Then when Mr. Kershaw in July, 1917 in dealing with the product of the German mill and any factors which he thought and stated had a bearing upon the rate of production, stated the following: "I control the character of the product as far as possible by the external and internal ventilation systems, installing fans if necessary", was he in accord, with his knowledge as there stated, in accord with what you have been endeavoring to tell me, or telling me.

MR. WHITCOMB: Now, our objection is that that question should be framed without reference to anybody's testimony, because that relates to a written memorandum and not actual facts as to an article in existence at the date.

THE COURT: Well, I think the chances are your objection is a good one, but I do not think on the ground you have put it. Although we have stepped way over the bounds again and again and again, and I have done it myself, I still cannot grasp the idea of asking one witness whether another witness is correct. After all, you are after facts. Now, this is, of course, cross-examination.

MR. MORRIS: I don't mind changing my question,—

A. Yes.

By Mr. Morris:

Q. Where do the rubber gloves come in, and what for?

A. There is simply a box that—in which you can manipulate anything in a—in an inert gas.

Q. What was the cradle?

A. Cradle was brass type of holder which we always use, little holder, specimen holder.

Q. And was that put into the camera?

A. That was then put into the camera and the camera immediately evacuated.

Q. And the brass cradle left in?

A. The brass cradle was holding the powder, yes.

Q. All right.

A. Of course, the brass—any brass pieces are entirely away—

Q. So that—

A. —from the portion—

Q. So that you think, Dr. Clark, as an expert that there was less possibility of some addition being made during all those steps to your sample than there was to Dr. Davey's or Dr. Anderson's sample, and where Dr. Anderson testified that he put it in, in his small tube in an inert gas, do you think with all that operation of yours there was less chance of changing than there was—and I am speaking in good faith, now, Doctor, you may think not, but I am—that there was less chance in yours of having contamination than there was in Dr. Anderson's, let us say, who used a copper target in his X-ray machine, and who used an inert gas in which to pack his—well, "pack" is not the word, but I can't think of a better one at the moment—his material under inspection, or not?

A. I haven't any question about the—I have n

doubt of the precautions which he has used, I am perfectly willing to admit that there are several steps in this, but to the best of our ability we have exercised in the preparation of that sample, because it meant so much, every precaution that was humanly possible to make. I haven't any—I am perfectly willing to admit that there are many more steps in it than there were in simply filling a mixed oxide into a glass tube under nitrogen.

Q. Each step gave an opportunity, at least, a potential opportunity, for something to happen, didn't it?

A. Well, we—it did, of course.

Q. Surely.

A. But—

Q. If I interrupted you, go on, Doctor.

By Mr. Whitcomb:

Q. But what?

A. I say we, as far as humanly possible, we tried to circumvent any such possibility.

By The Court:

Q. Are you definitely of the opinion that there was no contamination

A. Yes, I am. I feel that there was not enough contamination of any kind to have produced visible, measureable X-ray lines of any kind.

By Mr. Morris:

Q. If I understand you aright, Dr. Clark, in your work sheets you had lines other than the Pb lines and the so-called Pb_2O lines, on your Exide sheet number 10, on Plaintiffs' Exhibit 21, did you not?

A. There were some additional faint lines, yes.

Q. What compound would you have if you in-

Q. Did Ferrari have any lead oxalate in his material which—from which he derived, found approximately a like lattice pattern?

A. He might very easily have had some oxalate there. Of course, we don't know.

Q. The probabilities are he had, from what he disclosed, isn't that true?

A. Yes.

THE COURT: Well, now, it is time to relay stenographers; and incidentally, Judge, don't you think we are going away beyond the limits of cross-examination?

(Discussion off the record.)

(Recess at 3.22 o'clock P. M.)

GEORGE L. CLARK, recalled.

Cross-examination (Continued).

By MR. MORRIS:

Q. There is Co_2 in the atmosphere, is there not, Doctor?

A. Yes.

Q. And sometimes it is more intense in the laboratory than in the atmosphere?

A. Yes.

Q. So that sufficient contact with Co_2, sufficient contact of Co_2 with powdered lead would create lead carbonate?

A. It could, yes.

Q. Dr. Clark, how many elements or compounds have a face-centered cubic type structure

THE COURT: Hasn't anybody, on either side, run any of these experiments in ordinary atmosphere?

MR. MORRIS: Not ordinary atmosphere?

THE COURT: Yes.

THE WITNESS: Yes, we have made plenty of films.

THE COURT: What?

THE WITNESS: In plain air, yes.

THE COURT: Does it show any carbonate lines?

THE WITNESS: No.

By MR. MORRIS:

Q. Is there any Pb_2O lines on those films?
A. Well, not usually, no.

MR. WHITCOMB: But, sometimes, did they?

THE WITNESS: Yes. Yes, when there was strong samples, strong samples would show some of them.

By THE COURT:

Q. But none of these samples that you ran in the air showed the carbonate lines?
A. No, if there was any carbonate there, it was in too small an amount to show.

THE COURT: All right. Did Dr. Anderson run any in the air?

DR. ANDERSON: No.

(Discussion off the record.

A. These samples were—just as soon as we had this body of liquid, about five hundred C. C., just the minute that that was finished, why, we started the vacuum.

By The Court:

Q. How much is five hundred C. C., in units of teacups?

A. Well, that is, let's say, about—oh, a pint, or something of that kind.

Q. Yes.

A. That would be a good idea.

Q. All right.

By Mr. Morris:

Q. That is a pint of liquid, and the powder that is carried—

A. Well, I have under-estimated that, it is probably more nearly—probably about eight hundred C. C.

Q. All right.

By The Court:

Q. Nearer a quart?

A. Well, yes, a little under a quart, something like that.

Q. Yes.

By Mr. Morris:

Q. So that the length of time that this was in the purified hydrocarbon would probably be how long?

A. It was in the hydrocarbon, let's say—first, put the solid in under the surface of the hydrocarbon, then the—about six minutes altogether in the mill, and then the vacuum distillation or vacuum evaporation, that lasted for about a half hour.

Q. All right, will you give me the total, because I might add wrong?

A. Well, let's say about—about forty minutes, I think, between forty and fifty minutes; of that order, at any rate.

Q. When it was taken—

A. It was done as rapidly as possible.

Q. And when it was taken from the test tube and put into the first liquid that operation was done under the protection of an inert gas?

A. Yes, nitrogen.

Q. Nitrogen?

A. It was introduced—

Q. What became of the nitrogen? Did you put it into the centrifuge, also?

A. Nitrogen was passed through the outside shell of the—

Q. Of the centrifuge?

A. Centrifuge, yes.

Q. And what was the inert gas which you had in the bottle into which you dumped or spilled or ran the discharge from the centrifuge?

A. Nitrogen was flowing into it all the time, so as to keep—

Q. So that—

A. —any ingress of air—

Q. So that during that operation, as I understand you, you took the sample from the test tube, you put it in nitrogen, you put it into a hydrocarbon, you put the hydrocarbon carrying the lead dust interspersed or disseminated in it into the centrifuge, you took that out and again put it in nitrogen, then you proceeded to use it, to evaporate what, the hydrocarbons?

A. Evaporate the liquid which was left, yes.

Q. By what process?

A. Vacuum.

Q. A vacuum, and then—

A. At a low temperature, about—

cluded those lines with the other lines in a single compound?

A. We have been unable to make any match at all. There were three or four, three—two, certainly, and possibly three or four of the very weak lines that have—that match or seemed to agree with those for lead sulphate, but only—you cannot make any safe conclusion from that. We felt that the explanation was possibly that there were just enough SO_3 fumes or something of that kind, in the production of the mill oxide in the atmosphere to produce very minute amounts of lead sulphate, which would not appear except under such extreme fractionation condition.

Q. You could not get that from rubber gloves, could you?

A. I beg your pardon?

Q. You couldn't get the source from your rubber gloves, could you? You couldn't get those lines from contamination from your rubber gloves?

A. No, those rubber gloves had been very carefully treated with alkali, and so on.

Q. All right.

A. Of course, they were used, the materials used with rubber gloves were not more than thirty seconds, probably.

Q. Well, that doesn't have—that is not the controlling factor, necessarily, is it?

A. No.

Q. No, but I don't understand, Dr. Clark, why you cast those lines into the discard. Won't you help me on that?

A. We have not cast—we have not been able to identify the additional lines, other than it is some additional impurity, you can see it in the microscope.

Q. All right.

A. Very small amount.

Q. But what I don't understand is why you are able to tell me that some, fewer than all the, let's call them superfluous lines, did not indicate a specific compound.

A. I don't quite get the drift of your question, Judge Morris. I am sorry.

Q. Let me try it again.

A. Yes.

Q. Because there is nothing mysterious about it.

A. Yes.

Q. See if I can make it clear. You called certain of your lines Pb_2O, didn't you?

A. Suboxide, yes.

Q. Well, yes, if you prefer the newer definition for suboxide, all right, I am not quibbling on that, but you called certain of your lines suboxide, but you had more lines. Now, I don't, I don't as a layman understand why those lines did not take—those lines taken in the aggregate did not tell you that here is a compound, that on this film the diffraction pattern of a compound which gives all the lines which you found on your film. Is there any sense in that question?

A. I think I understand—

Q. All right,—

A. —what you mean.

Q. —won't you help me out?

A. Well, in the first place there was—by any combination we could make the lines did not fall together, any type of pattern.

In the second place, we were considering the lines of largest intensity.

In the third place, the interpretation was made upon the basis that there was in this product by microscopic examination a whitish, opaque substance, and another very, very—very minute in amount. The strong lines in this, in this pattern made by the frac-

tionation process are those which we find in other measurements, previous measurements. The new ones, the new lines, which are weak, have not appeared in the mixed or mill oxides simply because evidently the amount of whatever it is is far below the possibilities of registration, and that, of course, is brief—is the interpretation I have given to it.

Q. You mystify it by reason of my lack of information. I don't understand why—well, that may take too long.

Let me ask you this, you say that you had found these discarded lines nowhere else.

A. That is right.

Q. But you had found the lines which you dotted on the film somewhere else. Where had you found those lines?

A. Those, those other—those lines, of course, by far the strongest one on the film being this so-called 2.60 line, 2.61, 2.64, 5 and 6, had been found in other samples, lead balls, mill oxides, oxalates, lead and oxygen, and so on.

Q. Now, but who else had found them besides you, if anybody?

A. Nobody had found these same lines.

Q. Nobody had found the 2.60 line?

A. Well, we think—

Q. Hadn't Ferrari, that is what I am getting to, of course, as you well know,—

A. Yes.

Q. —hadn't Ferrari?

A. Ferrari had a line of 2.69.

Q. 2.69?

A. Yes.

Q. All right. Now, did you find all the Ferrari lines? I have forgotten whether you told me you had or not.

A. Two of them, I think, two of them corresponding to his we did not—

Q. Well, in approximation,—

A. Yes.

Q. —I am not trying to pin you down to it, so that the lines—

THE COURT: Well, he hadn't got in the answer yet.

MR. MORRIS: I thought he had.

THE WITNESS: Two we did not find. There was one in our pattern which he didn't have.

By MR. MORRIS:

Q. There was one in your pattern which he didn't have?

A. Yes, that is shown on that color chart, wherever it is.

Q. Then, as I understand, the situation is this, you had in your lines the Ferrari lines and two, three or four more lines, I don't know whether it is two, three or four, somewhere in that neighborhood?

A. Let me see—something of that order, yes.

Q. Approximately?

A. Yes.

Q. Now, then, you attributed to the lines that you could compare with certain approximation to Ferrari's lines and one of your extra lines—I can't finish the sentence as I started it, so I will have to withdraw it.

So you concluded—withdrawn again; so that you assigned to the material which gave those lines, less the superfluous lines, minus one, the same designation that Ferrari gave to his approximately like lines?

A. Yes, because that pattern, the lines seemed to approximate best to a cubic—face centered cubic type of lattice.

THE COURT: Go ahead.

MR. MORRIS: Just two more questions, if you will, Dr. Clark.

By MR. MORRIS:

Q. How many compounds have the face-centered cubic type of structure?

A. Well, there's a considerable number of face-centered cubic type structures, if we take all the chemical elements, metals, and those compounds which, with a heavy and light element, which give you an essence, a pattern which looks like a face-centered pattern.

Q. Calcium chloride?

A. Calcium fluoride, zinc blende, sodium iodide, and so on. I don't know just how many there are.

Q. A dozen, perhaps?

A. Yes.

Q. Or two dozen?

A. Yes.

Q. Will you give me the best proximate, approximation that you can make?

A. Well, there at—there are at least—there are ten or twelve, I have forgotten how many, pure chemical elements that have a cubic face center.

Q. And compounds?

A. And compounds that show a face-centered type of lattice. About two dozen, I should say.

Q. Now, will you be good enough to tell me how many with a cuprite structure?

A. Cu_2O and Ag_2O and Pb_2O.

Q. Are there any others?

A. Well, of course, you can't—I mean, if you have an element, very heavy and one light, you can't, you wouldn't know whether it was cuprite or not, but those are close in structure.

Q. That is, if there is a wide spread, is there not?
A. Yes, sir.

MR. MORRIS: I thank you, Dr. Clark.

Re-direct-examination.

By MR. WHITCOMB:

Q. For fear it is not clear, would you mind stating here, in these centrifuge samples you believe that none of the hydrocarbons entered into the mixture and caused any erroneous conclusions to be present in your test?

A. Well, Dr. Davey made the point that an adsorbed film of these hydracarbons might easily oxidize. Of course, our effort, and I don't know—I can't possibly see how there was any access of oxygen during any time when the hydrocarbon was present.

Q. Then, these many precautions you pointed out were just for the purpose of avoiding such a occurrence, is that right?

A. Yes.

Q. There's one other question. You don't place your whole reliance on the finding of a suboxide—

THE COURT: Before you get to that, wait a minute.

By THE COURT:

Q. If you just take your lead oxide and put it in a hydrocarbon, are the two things indifferent to each other entirely?

A. Yes, they are. Lead oxide would dissolve.

Q. They are entirely separate?

A. Yes, sir.

Q. So that the carbon in hydrocarbon will, in no possibility, enter into the lead oxide?

Q. And in making that evacuation you dissipated or removed likewise the nitrogen that had not been driven out?

A. Yes.

Q. By the presence of the heavier liquid?

A. Yes.

Q. How did you dry it?

A. This material was then put over—in a vacuum desiccator over P_2O_5, the vacuum being renewed, oh, every twenty minutes or so, and was so kept.

Q. Now, well, you subjected it to the X-ray analysis, didn't you, Dr. Clark?

A. Yes, yes.

Q. Well, now, you didn't keep it in there when you were subjecting it to the X-ray analysis, did you?

A. No, no.

Q. Now, how did you get it out?

A. Simply was taken—the container was taken out and the sample mounted on our—on the little wedge in—the camera being in a stream of nitrogen all the time.

Q. Well,—

A. And then the X-ray pattern was made by vacuum—

Q. I am coming to the X-ray pattern.

A. All right.

Q. If you will, let me follow the process, because I have had difficulty in doing it. It was taken out of the desiccator and made into a wedge. Now, won't you tell me about that?

A. In all of this—in this work we have a—a small cradle, in which the powder is placed.

Q. In an atmosphere of nitrogen?

A. It was done in an atmosphere of nitrogen, with the extremest precaution, because of our fear of very great activity, and, in fact, we have—

Q. How cool was it when you finished drying?

A. The temperature was about—after drying in the desiccator, you mean?

Q. Yes.

A. Room temperature, 25 degrees.

Q. I see, and then will you proceed with the process, Dr. Clark, please?

A. Yes. We have, of course, a box, air-tight box for—with rubber gloves and things of that kind, that are used for unstable, mounting unstable compounds, those that absorb water very rapidly, and things of that kind, in which either very dry air, or stream of nitrogen, or CO_2, or things of that kind can be done. The sample was then with the drum, the drum of the camera—

Q. No, but I just don't get—I will come to the camera, but I am still mystified as to how you got this powder out of the desiccator and made it into a wedge. Now, it may be perfectly clear to you, such a simple process to you that you haven't made it clear to me.

A. Yes, well, we have these little—little cradles, little peaks on each end, in which the powder is placed, in this little—little holder, which can be detached entirely from the X-ray camera, and so on, and this was done by introducing the sample, sealed sample, that is, which had been kept in the vacuum desiccator, in this little stirrup or little holder, and the—by means of the rubber gloves, and the box, some of the powder was poured out into this, and with a clean porcelain edge spatula it was leveled off on the two sides, so the wedge top was formed.

By The Court:

Q. All under nitrogen?

A. All under nitrogen, yes.

Q. All under nitrogen?

A. Not unless there was some peculiar conditions where oxidation took place.

Q. And if you prevent oxidation?

A. I think it is perfectly safe. We use those hydrocarbons and toluene for making density tests.

By Mr. Whitcomb:

Q. Is that the toluene that Dr. Ullmann referred to in making his demonstrations?

A. Yes, and that's what we used.

By The Court:

Q. Well, if it corresponded to it?

A. Yes, both have hydrocarbons present, yes, sir.

By Mr. Whitcomb:

Q. I think there was some little confusion maybe about the amount in agreement and which you obtained from the centrifuge. Somewhere it got into the record as only a tenth of a gram. Was that the total amount?

A. No, We used that little bit in the chemical analysis. There have been from the various fractionations may be from the three different kinds of materials several grams.

Q. There was one question about proteins that came up. Will you please state what your position is with respect to the X-ray work in proteins as having a standard of comparison to which to turn to?

A. Proteins have been one of the mysteries and, of course, one of the most important things that we have, that we are large users of, we are large users of proteins ourselves, and in a case of that kind, although some effort can be made towards a chemical analysis of hydrogen, carbon, sulphur, nitrogen, and so on, yet no one has any idea of how those are put together. Hair and those things like that produce very

beautiful diffraction patterns. Under the leadership of Asbury, in England, and the straight-forward comparison of those, both—although no comparison of any previous standard of that kind has been made—proteins, that has been the most useful tool in determining what a protein is or that has ever discussed it.

Q. You really do rely on them?

A. Yes.

(Discussion off the record.)

By Mr. Whitcomb:

Q. Please state whether or not some of these drawings, like this one of the '151 patent or the '149 patent, or others, show the idea, diagrammatically, at least, of actually getting the air into the drum in which the metal is rotated—please refer to that and say whether or not that illustrates what you are pointing out in contradistinction to the discussion you had of this German Tudor type?

A. Yes. These diagrams show there (indicating) a pipe clear into the drum or running right up to the end of the drum, admitting or drawing air into the drum.

Q. And your idea is that this provides a means which would eliminate that chance which you say might exist in the other type, where it was just drawn around the drum, is that right?

A. Yes. This (indicating) introduces the air directly into the drum.

Q. This was the feed that you talked about in your eight grades of reactions in your original testimony?

A. Yes.

(Discussion off the record.)

were corroborated but not anything beyond his testimony.

MR. WHITCOMB: No, sir.

THE COURT: All right. That is stipulated and agreed to between the parties.

RETURN OF LETTERS ROGATORY.

Examination of GENZO SHIMADZU, a witness on behalf of the plaintiffs (upon interrogatories):

Direct-examination.

My name is Genzo Shimadzu. I'm sixty-eight years old and my present address if 429 Funayacho, Higashinotoin-dori Oshikiji-Sagaru, Nakagyo-ku Kyote-shi. I am the president of The Nippon Denchi Kabushiki Kaisha, The Shimadzu Manufactory Kabushiki Kaisha and The Lead Pigment Kabushiki Kaisha of Japan. I have been in the business of manufacturing electric storage batteries since the year 1895, right after the Sino-Japanese War. Therefore, I have 41 years experience. I have had the same number of years experience in connection with the manufacture of lead type storage batteries. I began making the principal ingredient of the active material used in the plates of electric storage batteries of the lead type in the year 1918, therefore I have about 18 years experience.

I was first engaged in the manufacture of the electric storage batteries in Japan the year 1895; at that time I had an establishment of my own called, Shimadzu Storage Battery Manufactory. I was the owner

and directed all manufacturing processes. I owned the Shimadzu Storage Battery Manufactory. Later in January 1917, Shimadzu Storage Battery Manufactory became the Nippon Denchi Kabushiki Kaisha. At that time I was the managing director of the Nippon Denchi Kabushiki Kaisha. In the year 1926, I was made president of the Nippon Denchi Kabushiki Kaisha and am still holding the office. As I said before, it is 41 years since I started making electric storage batteries. It is 18 years since I first started the manufacture of the active materials for the plates of lead storage batteries.

The company obtained the active materials for the lead storage batteries from five stores. The names of the stores are as follows:

Namaishi Shoten of the City of Sakai
Nippon Paint Co. of the City of Osaka
Kansai Paint Co. of the City of Osaka
Abe Paint Co. of the City of Osaka
Nippon Industrial Chemical Co. of the City of Tokyo

The active materials I used were red lead and litharge. There were three different methods of making the active materials known. The first: lead oxide is formed as a scum on the surface of molten lead. This scum is continuously removed, so that a fresh surface of the molten metal is oxidized. A yellowish gray powder may be collected, which is a mixture of the oxide and the finely divided metal. If this powder is further roasted, it is converted into a yellowish red form of lead oxide. The second: heating of metallic lead with sodium nitrate and the third: from white lead.

I first considered the matter of making the active

materials for the lead storage battery plates in the year 1918. As I said before, I was buying the active materials from the five above mentioned stores, but the quality of the active materials was inferior and the price was too high. Furthermore, the quality obtained differed from time to time and this, consequently, affected the uniformity of the product. Those were the primary reasons why I considered seriously making the active materials myself. I hoped to obtain chemically pure active materials of uniform quality. I contemplated the possibility of using the process of making powdered lead directly from the metallic lead, thinking this was possible because gold powder was made directly from metallic gold. In the year 1906, I sent machinery for making chinaware to Szechwan and Hunan, China, by order of the Chinese government. Among the machines I sent was a pot-mill used to powder the raw materials of chinaware. I thought the pot-mill was the machine I needed so I decided to use a small size pot-mill, made of porcelain. I made experiments on the machine, which I sold, in 1887, to Iwatsubo Gold Leaf and Gold Powder Co. for making gold dust and also on the machines belonging to the Kyoto Research Laboratories of Chinaware of Japan. The primary aim of this research was to utilize the effect of frictional shear caused by the contact of the particles of metallic lead themselves.

The experiments I carried out on the pot-mills which I borrowed from the Kyoto Research Laboratories of Chinaware of Japan, consisted in determining, the effect, by changing the revolutions per minute of the pot-mill and also the amount of feed of the particles of lead to the machine in every conceivable combination. The result was practically failure, because the lead powder produced was too coarse to be used as the active material for the lead storage bat-

teries. Furthermore, the method was too slow to be used for industrial scale production. However, I concluded there was a possibility of making lead powder just as gold dust. The above experiments were undertaken during the month of September 1918. I have no original drawing of the very first apparatus used by me in carrying out such method. I hereby certify that this (Fig. 1 attached to answers to interrogatories) is the correct photostat of the original drawing.

Ever since the time when I owned the Shimadzu Manufactory I was manufacturing machines for chinaware, especially crushers for crushing the raw materials of chinaware. Among the first machines I sold were the ones sent to Szechwan and Hunan, China, ordered by the Chinese Government in the year 1906. I experimented on the porcelain pot-mills, made for chinaware raw materials, to produce lead powder, in the year 1918. Previous to this experiment, I also experimented on the machine I sold to the Iwatsubo Gold Leaf and Gold Powder Co., to produce lead powder. This experiment was carried out during the month of February 1918, in the Iwatsubo shop in Kyoto. This is the photostat of the original drawing of the machine, this photostat is merely a reference (Fig. 3). The raw materials I used were lead balls, about one inch in diameter. The product obtained was lead powder. The pot-mill was revolved, regulating the amount of feed. The quality of the product obtained was such that it was not suitable to be used in the storage battery so I decided to experiment on some other method. These are the drawings of the machines used for the experiment, namely, the drawing of the pot-mills, I have shown you before (Fig. 1) and this (Fig. 3) I hereby certify, these are the correct photostats of the original drawings. The Fig. 2 I have shown you before was used sometime in February, 1918. The Fig. 1 and Fig. 3 were used sometime about September, 1918.

Re-cross-examination.

By Mr. Morris:

Q. There's one question. If I understand you now, Dr. Clark, that has greater virtue in power in this rotating drum than if it is taken in through the periphery of the drum or the holes in the shell of the drum. Is that right?

A. I feel that the actual, directed introduction through one duct or one pipe makes positive, makes it positive that the air gets in there.

Q. It has fourteen hundred and eighty-two opportunities to get in, and if it has only one to get in, it does get in?

A. I should say, yes, through this one (indicating). It certainly does. But the other, it might or it might not.

Mr. Morris: That's all, thank you, Dr. Clark.

(Discussion off the record.)

Mr. Morris: That is all the witnesses we have, I believe.

Mr. Morris: We want to introduce one paper.

Mr. Schaffer: The Plaintiffs offer in evidence the draft of Dr. Wilson submitted by the Defendant, in connection—

The Court: Pardon me. Well, you offer all your exhibits, don't you? You have already, I guess.

MR. SCHAFFER:—submitted by the Defendant at the Plaintiffs' request.

THE COURT: I will assume that all the exhibits have been offered, by both sides, and all will be received, except those objected to.

MR. BETTS: If your Honor please, we also have outstanding the letters rogatory on deposition that was sent to Japan of Benzo Shimadzu, Tominosuke Hichijo, and Suyeharu Uchiyama.

(Discussion off the record.)

MR. MORRIS: I am willing to stipulate that if they are delivered in three weeks period, but I don't believe that those things ought to be taken at this stage of the case. Of course, they are in chief and, in fact, the dates, so far as any dates can be fixed, have been fixed.

(Discussion off the record.)

MR. MORRIS: Suppose I reserve the right to object to them when they come in.

THE COURT: All right, I will have that in mind. Can't we get this? Could it be stipulated that the testimony contained by these letters rogatory will not be offered in evidence for any purpose except in corroboration of Mr. Ishimura's testimony in this proceeding?

MR. WHITCOMB: Absolutely, we will be glad to.

MR. MORRIS: Also, the Defendant will be allowed to object to them on any ground?

THE COURT: Yes. I say we could go ahead and assume that that's what they will do when they get here, and we will proceed as though he

As I said before, the qualities of the materials produced were such that the particle size was too coarse, the apparent specific gravity being 3, to be used as raw materials in the storage batteries. The amount produced was also too small to be satisfactory for industrial scale production.

Next I experimented on a mortar type of vertical grinding mill to further powder the coarse particles of the lead previously prepared. I have no original drawing of the above mentioned machine. I hereby certify that this is the correct photostat of the original drawing (Fig. 4).

The method I employed next was that of using a revolving wooden cylinder made of cryptomeria. The revolving wooden cylinder I used had an orifice from which the product was obtained. The raw material, fed to the revolving wooden cylinder, consisted of lead balls about one inch in diameter. By regulating the feed, the quantity of product was determined. The particle size of the product thus produced was fine enough but the product was contaminated with small wooden fragments from the cylinder. The color of the product was greenish gray. This method was tried in the laboratory of the main factory of the Nippon Denchi Kabushiki Kaisha during the month of September 1918. The lead powder produced by this method was very fine in particle size, the apparent specific gravity being less than 2. The conclusion drawn from the above experiment enabled me to visualize the possibility of employing this method to produce finer lead powder for the storage battery. The objection was the wooden fragments mixed in the product. The attached is the correct photostat of the drawing of the machine used (Fig. 5). I experimented further with a drum made of iron. I experimented further on a drum made of iron. The drum was 60 inches in diameter and 60 inches in length. Lead balls were first introduced into the iron cylinder through

an orifice, then the drum was revolved. The most advantageous point as to the number of revolutions per minute and the amount of feed were experimentally determined and the percentage of the output was 1% of the input per hour. The pulverized lead thus produced had the apparent specific gravity of 2.4. I carried out this experiment in the branch factory of the Nippon Denchi Kabushiki Kaisha during the month of December, 1918. Attached is the correct photostat of the original drawing of the drum mentioned above. The reason I cannot attach the original drawing is that I have only one original drawing on hand (Fig. 6). The speed of the revolving drum was about 14 revolutions per minute.

The next thing I did I effected separation of the finer powder from the coarser powder by means of an air current. This experiment was also carried out in the branch factory of the Nippon Denchi Kabushiki Kaisha during the month of December, 1918. The separation of the finer lead powder from the coarser lead powder by mechanical means was possible, but the method has no industrial value because I had no use for the coarse powder of lead left behind. The attached is the correct photostat of the original drawing (Fig. 7). In order to secure a finer and better lead powder, I next tried the Buhr stone mills made in France. This experiment was also carried out in the branch factory of the Nippon Denchi Kabushiki Kaisha, during the month of December, 1918 (Fig. 8). The machine with which I experimented next was a horizontal grinder. I drew the conclusion, from using those machines, that mechanical means of making a finer powder was impossible. The attached are the correct photostats of the original drawings of the machines used. (Fig. 8 and Fig. 9.)

I did not try in any previous trials to introduce

air into the rotating drum. I first came to experiment with the introduction of air when, one day, while I was doing an experiment, I saw very fine lead powder piled up on the bearing bracket of the grinding machine. Then and there I thought of introducing air to effect the separation of the finer lead powder from the coarser. This is the correct photostat of the original drawing showing the machine so used. The original drawing was drawn by Mr. Luyho Ishimura, an engineer of the Nippon Denchi Kabushiki Kaisha on the 26th day of December, 1918 (Fig. 10) at the Nippon Denchi Kabushiki Kaisha. Figure 11 is the correct photostat of the original drawing of the blower.

I ordered the machine from the Mitsubishi Ship Yard of Kobe, naming it as a drum, and received same in November, 1918, at the Nippon Denchi Kabushiki Kaisha. I do not know whether the Mitsubishi bought their materials required for the construction of the above mentioned drum. The machine was assembled, under the direction of Engineer Luyho Ishimura, for operation in the branch factory of the Nippon Denchi Kabushiki Kaisha during the month of November, 1918. I first operated above mentioned machine using the iron plate drum with the air inlet tube during the month of December, 1918, at the branch factory of the Nippon Denchi Kabushiki Kaisha. On the 26th day of December, 1918, I ordered Mr. L. Ishimura to make the drawing of the assembled machine. This is the correct photostat of the original drawing (Fig. 12). The notary Yasugoro Abe's sign indicating No. 6605 was obtained September 30, 1919, on the drawing (Fig. 12) to avoid trouble in future. I introduced lead balls, about one inch in diameter, into the horizontally and revolvably mounted cylinder; within this cylinder was fitted a brass piping, an extension of the air blower, 1.5 inches in diameter, provided with small holes. The air

from the Roots blower was blown into the cylinder through the small opening. The color of the product obtained was black and was fine enough in texture to be used in storage batteries. The ratio of output was, 12.42 pounds to the feed of 1987.2 pounds, per hour, or equivalent to 0.66%. The primary reason of this small rate of output was due to the lack of knowledge necessary for the proper operation. The air blower I used was the Roots blower. The amount of charge of raw materials was 1000 kilograms of lead balls of 1.5 inches in diameter, together with 500 balls of steel, I inch in diameter. Air blast having a pressure of 21 inches of water was sent out of the air blowers; the volume of air used was 800 cubic feet per minute. The speed of the revolving cylinder was 15-25 revolutions per minute. The fine lead powder, produced in the cylinder was blown out of the cylinder through the discharge orifice, by means of the air current from the above mentioned air blower; the lead powder thus blown out was led into a collecting chamber. The collecting apparatus were made of 6. or 7. cotton bags, about 10 inches in diameter and 10 feet in length. These were each fitted air tight to the uncovered top of the steel boxes, each of which was connected to the main exhaust line; thus, the air carrying fine powder produced in the cylinder, passed through the cotton bags leaving the lead powder behind in the box. The lead powder collected in each box was removed from time to time (Fig. 15). Figure 15 as a reference. The temperature inside the drum was around 60° C. The temperature was determined by a mercury thermometer and controlled by regulating, by means of a valve, the amount of air blown into the drum. This is the correct photostat of the original drawing of the last mentioned successful complete installation (Figs. 13 & 14). Assembly drawing fig. 14 as a reference.

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As the result of industrial scale experimental research, I carried on from March, 1919, to the spring of 1920, on the machine, I finally succeeded in collecting necessary data, as to the best speed, the best amount of air to be blown in. Furthermore, I made improvements on the air line inside the cylinder by introducing jets. I also determined how and how much the temperature inside the cylinder affected the quality of the product. Finally, in June, 1920, my superhuman effort was rewarded materially. The batteries made from my product were high in dependability and long in life. From June, 1920, on, it was definitely established that the production could be carried out industrially as well as economically. The produced lead powder was extremely fine in its particle size and chemically very active. I discovered that it oxidized spontaneously in air and that if a few drops of water were dropped on it, oxidation commenced instantaneously, changing the black lead powder into yellow litharge. I also discovered that, during the experiment, the extremely fine lead powder, if damp, ignited freely on contact with open flame; especially reactive was the powder made at around 100° C, and at this temperature, I found that the yield increased many fold. The data taken in the temperature-yield experiment showed that, up to a certain point, the temperature and the yield increased proportionally. Thus the best results could be obtained if the temperature inside the drum was kept constant at a certain temperature, during the operation. The incoming air when it came in contact with the surface of the lead ball oxidized the metallic surface; as soon as the surface was oxidized, the friction and abraison reduced the oxide into powder and formed new surfaces on the lead pieces. The fine powder thus formed was suboxide, perhaps high in metallic lead content. I discovered at this

point that the product, on natural oxidation changed easily into litharge. On 17th of December, 1920, I filed my first application, No. 431,473 to the Government of the United States of America on the method of manufacturing litharge from very reactive lead powder. I thought this process, that is: the surface of the metallic lead being caused to be acted upon by the air or other oxidizing agent, and to be covered with a coating of lead oxide, which being brittle and lacking tenacity compared with metallic lead, can be easily and quickly reduced into powder by abrasion, and as soon as a new metallic surface of the pieces appears, it being instantly oxidized and abraded, thus continuously producing the desired powder, was a great discovery, especially the experiment proving the phenomenon of oxidation of powdered lead in air, so I thought it was a worthwhile discovery to obtain foreign patents.

I started the industrial scale research in the process described in the U. S. Shimadzu patent No. 1,584,149, in March, 1919, using an iron cylinder 60 inches in diameter, and 60 inches in length, and an air blower.

As claimed in 1: a method of forming a finely divided and chemically active lead powder, which comprises introducing relatively large masses of lead into a rotatable vessel, rotating and forming lead powder by rubbing of the masses against each other.

In Claim 1: I showed that even if the air supply was momentarily stopped the chemical reaction will not stop because there is enough air present in the drum, in other words, I claimed that, this process could be carried out in atmosphere as well as under pressure.

In Claim 2: including the method mentioned in Claim 1, and introducing a current of air into the drum and removing the lead powder formed by rub-

bing the lead masses against each other from the drum by means of the current of air.

In both methods, steel balls were used to accelerate the operation.

From June, 1920, on I was performing experiments in the newly built lead powder factory, producing at the same time for commercial purposes. The method comprising in putting in a rotatable drum pieces of metallic lead, keeping these pieces at a temperature high enough so the incoming air readily oxidizes the surface of the lead pieces and reduces them by abrasion into a very fine powder, which is chemically very reactive; the lead powder thus formed is carried with air current through the opening in the one end of cylinder, into a suitable chamber.

The rate of production increased gradually as the necessary data on the process were determined. Finally, in 1921, successfully reaching as high as 100 pounds per hour.

Contrary to the belief held before, I discovered that the lead powder thus produced contained primarily lower oxides of lead and only a few percent of metallic lead. In 1922 I began exact qualitative analysis of the product.

The present rate of production is a little over 800 pounds per hour.

Claim 1 of U. S. Shimadzu Patent No. 1,584,150 claims especially: 1. A process of manufacturing a fine powder of lead Sub-oxide (lower lead oxides) intermingled with powder of metallic lead comprising in putting pieces of metallic lead in a rotatable vessel, introducing into the vessel currents of an oxidizing gas to oxidize the surface of the lead, while rotating the vessel and abrading off the oxides formed on the surface.

Claim 2 of U. S. Shimadzu patent No. 1,584,150 claims especially:

Introducing into the vessel, mentioned in Claim 1, while rotating blasts of a gas containing oxygen, such as air, causing such blast to blow the powder produced out of the vessel.

Claim 3 of U. S. Shimadzu patent No. 1,584,150 claims especially:

A process of manufacturing a fine powder of sub-oxide intermingled with powder of metallic lead comprising in putting pieces of metallic lead in a dry state into a rotatable vessel, and delivering an oxidizing gas into the vessel while revolving the vessel.

Claim 4 of U. S. Shimadzu patent No. 1,584,150 claims especially:

A process of manufacturing, described as above, and rotating the vessel maintaining the temperature within the vessel at not less than 60° C., at the same time introducing into the vessel an oxidizing gas.

Claim 6 of U. S. Shimadzu patent No. 1,584,150 claims especially:

A process of manufacturing, described as above, and stressing the importance of maintaining the temperature of the material at not less than 60° C., by the heat generated by friction and chemical action.

8: In the production of a finely divided mixture of sub-oxide and metallic lead, the step of tumbling together and agitating a mass of hard heavy material containing metallic lead, while maintained at a temperature between about 60° C. and 100° C.

Claims 9-13: A method of forming a finely divided lead powder described as above and paying of special attention as to the regulation of the speed, the feed and the temperature.

The temperature inside the vessel is gradually raised as the vessel starts rotation. As the temperature approaches the desired maximum point, the percent content of the metallic lead and oxides of lead in the product changes gradually, that is to say, there is formed in the product oxides of lead and metallic lead in a form of powder, the oxides predominating.

From the Spring of 1919 to the beginning of 1920, I often experienced producing a yellowish powder, especially on a rainy day. The cause was found to be the moisture carried with air into the drum through the jets, from the outside.

This caused further oxidation to take place and generated much heat, changing the produced powder into yellow oxide of lead.

When the yellowish powder was ignited in an open crucible, a reaction took place, generating much heat and changing the whole masses into yellow litharge.

The U. S. A. Shimadzu patent No. 1,584,151 was based on this principle.

Claim 1 stresses:

A process of forming finely divided oxygenated lead compounds which comprises treating a finely divided chemically reactive powder comprising major portion of lead suboxide with an oxidizing substance, stressing the industrial importance of utilizing the heat of reaction, initiated by the humid air used.

Claim 2 stresses:

A process of forming finely divided oxygenated

lead compounds, which comprises treating a finely divided chemically reactive powder comprising lead suboxide and metallic lead powder with an oxidizing substance, and maintaining the reaction by the evolved heat of reaction.

Claim 3 stresses:

The process of forming a finely divided oxygenated lead compound which comprises powder comprising a major portion of lead suboxide with an oxygen containing substance and continuing the reaction by the evolved heat of reaction.

Claim 4 stresses:

The method of forming finely divided lead oxide which comprises treating a finely divided chemically reactive powder, comprising a large proportion of metallic lead with air, and continuing the reaction by the evolved heat of oxidation.

Claim 5 stresses:

The method of forming a finely divided oxygenated lead compound which comprises contacting finely divided chemically reactive powder comprising a major proportion of lead suboxide with moisture and continuing the reaction by the evolved heat of reaction.

The product mentioned in U. S. A. Shimadzu patent No. 1,584,150 is similar to the product mentioned in the U. S. A. patent application No. 431,473 filed and withdrawn December 17, 1920, namely chemically very reactive lead powder.

The processes claimed in U. S. A. Shimadzu patent No. 1,584,150 Claims 14, 15, 16 and 17 were based on the properties of product peculiar to the product obtained from the spring of 1919 on.

The Japanese Patent Law requirement on inventions stresses the importance of priority. After I started the experiments on the making of the lead powder I partly completed the process in the spring of 1919, and in 1920, when I almost completed the industrial process, I filed an application for the Japanese patent on the above discovery in December, 1920. Thereafter, on discovery of each improvement, I filed an application for each improvement. These patents are all more or less based on the Japanese Shimadzu patent #41,728 filed on the 21st day of November, 1920.

On almost all applications filed the patents were granted; some of them as an improvement in parallel to the Japanese Shimadzu Patent #41,728 and some as separate patents, all on the process of making the lead powder.

The Japanese patents were obtained, some of them through a lawyer and some of them by filing applications myself.

The patents applied for in the United States are more or less on improved methods based on the Japanese patents. Therefore, the dates set on the U. S. Shimadzu Patents might not coincide with the dates of the Japanese Shimadzu Patents. Similarly, the claims of the U. S. Shimadzu Patents may not be the same as the claims of the Japanese Shimadzu Patents.

The date of filing my application on the U. S. Patents in Japan, I firmly believe should be under the jurisdiction of the United States patent law.

The United States Shimadzu patents were obtained through Mr. Morio Nakamatsu, a Japanese lawyer of Tokio. I also obtained my Japanese patents through him, and this previous knowledge and experience enabled him to translate what I have told him orally about the invention.

Those patents were applied through the firm of Marks & Clerk of Washington.

As has been previously answered in interrogatory (4-11) the United States patents, obtained on the processes and methods of making the lead powder, were seriously considered and then condensed before taking out each separate patent.

As to the conceptions and experiments on the technical information, which has been stated in the Interrogatory (4-11) I aimed in the beginning to produce a very fine lead powder for storage batteries. As the experiments progressed, the lead powder produced was not exactly ordinary lead powder but chemically a very reactive lead powder, differing greatly in properties from the ordinary lead powder.

If dampness permeated this powder in the air, I experienced that it, when ignited, changed the lead powder into yellow litharge.

At first I thought the lead powder produced at low temperature was metallic lead, fine in its particle size, but after many experiments I found that if an air nozzle is inserted into the cylinder and air blown through while the cylinder was rotating, and the temperature kept high, the powder produced was more reactive while at the same time the rate of production increased enormously. I concluded from this phenomonon that the lead powder produced consisted of lower oxide of lead. Believing this to be the case, I analyzed the powder and finally confirmed the opinion that the lead powder was suboxide of lead; but, upon further analysis, the lead powder produced was equivalent to a mixture of suboxide of lead and small amount of metallic lead.

The reason why I treated the product as suboxide of lead in the United States Shimadzu Patent #1,584,150 was that at that time the product obtained was only

known as a very low oxide of lead. On determining further the properties of the product, as can be seen in the later patent, I found the ingredients of the product to be similar to the ones mentioned in the later patent. With a substance such as lead which changes its properties with temperature and is unstable in air, it is very hard to determine its exact identity.

I know Mr. C. Reed Carey, because I met him in Kyoto. When Mr. Carey came to Kyoto in February of 1926 he came to the Shimadzu Manufactory, of which I am the president, and offered to the firm, the exclusive right of handling his company's product in Japan. Mr. Carey came to the Shimadzu Manufactory on his own accord on the subject mentioned above in February 1926. I directly heard the proposal from him.

After the greeting, I talked to Mr. Carey about my invention on the lead powder and told him that this powder, if used in storage batteries, will greatly improve the general qualities of the batteries. Then he told me that he had a good friend in the biggest storage battery company in the United States of America. He said he would tell them and ask them to use my products.

So I told him that if they wished, I would be glad to sell my patent rights in the United States of America. I showed him my factory and explained to him the process.

I took him to the branch factory of the Nippon Denchi Kabushiki Kaisha, and explained to him, while the machines were in operation, the size, the conditions of maintaining operation of machines, the air-blowing device, collecting chamber systems, and general conditions of the factory.

I gave Mr. Carey summary of processes of making lead powders, one with a circular explaining the ad-

vantages of using my products in the storage battery, and few others.

I do not remember exactly every circular I gave Mr. Carey then, but this is one of the circulars I gave Mr. Carey (Fig. 16). I gave Mr. Carey Lead powder, red lead, and litharge as samples. At that time Engineer Luyho Ishimura was in Berlin, Germany. He was to return to Japan through the United States, and taking advantage of the situation, therefore, I told Mr. Ishimura to visit Mr. Carey and talk about the matters concerning the subject. Mr. Ishimura reached the United States in June, 1926, and visited Mr. Carey in Philadelphia, Pennsylvania. Mr. Cary told Mr. Ishimura that he (Mr. Carey) told all about the Shimadzu process to his good friend, Mr. Smith, who is the chief engineer of Exide Company, the defendant in this litigation. Mr. Carey introduced Mr. Ishimura to the President and to the Directors of the Exide Company and Mr. Ishimura discussed the matter of business transaction with them many times. The details as to the matter discussed on the subject can be readily recalled by Mr. Luyho Ishimura, who is at present in the United States. These are the photostats of the original copies of letters exchanged with Mr. Carey at that time. (Fig. 17.) I firmly believe that I was the first one to discover the process of making a fine powder of oxides of lead so as to cause natural oxidation in the air and their production on an efficient industrial scale in a simple way. Japanese patents which are generally very difficult to obtain were granted for all my processes on account of the great value attached to the invention, especially of proving that lead powder oxidizes in the air. I was selected from amongst countless inventors as one of the ten greatest inventors of Japan, and was invited to the dinner reception given by the Emperor of Japan. This alone shows, I believe,

the real value of my invention. Subsequently, my inventions appeared in many books and magazines.

The names of the books and magazines are as follows:

Gmelin-Kraut's Handbuch der Anorganischen Chemie", Band Iv. Seite 809, u. 845.

Prof. Dr. Fritz Ullmann "Enzyklopadre der technischen Chemie" Seite 512 u. 523.

Prof. C. Drucker und Dr. A. Finkenstein, "Galuanische Elemente und Akkumulatoren" Seite 165.

J.W. Mellor, D. Sc. "A Comprehensive Treatise on Inorganic and Theoretical Chemistry" pages 514, 637-639, and 644.

Revu General L'Electricite, vol. 16, No. 20, page 792.

YuKichi Osachi D. Sc., Tsuzoku Kagaku Taiwa, pages 351-353.

Prof. Sonosuke Mori "Chuto Sinsei Butsurigaku Kyokasho" page 284.

Kogyo Kyoiku Kenkyukai and Shoko Chushinkai "Kaitei Butsurigaku" page 194.

I wish to say on account of the fact that my applications in the United States have been properly arranged from past improvements in connection with many Japanese patents there is not a single United States patent of mine that is identically the same as any of my patents in Japan.

Lastly I would like to say that the Mr. Hall who invented the machine used by the Exide Company, who are the defendants in this case, joined that Company in 1920; all this I understand.

Now, any invention takes a great deal of time and energy. In order to complete the invention, first an

idea is formed in the inventor's mind; it undergoes stages of mental development. Then it materializes, then it is made into a model in crude form, and requires many improvements and years of hard work. Even the greatest genius cannot in such a short time complete inventions of machines or processes, such as this, as is claimed to have been accomplished by Inventor Hall.

The date of filing my first application is not exactly the day when I completed my inventions, but even so, it was in August of 1920. This alone should prove the priority of my claim.

Cross-examination.

I have not manufactured nor have been connected with the manufacture of lead type electric storage batteries in any country outside of Japan. I have had no connection whatsoever with any battery company in Japan which was subsidized by the Japanese Navy or Arsenal.

I am President of the Nippon Denchi Kabushiki Kaisha. The Nippon Denchi Kabushiki Kaisha does not belong to the Mitsubishi concern. The Mitsubishi concern is merely one of the shareholders. The Nippon Denchi Kabushiki Kaisha was organized in January, 1917. The Shimadzu Storage Battery Manufactory owned by me since 1895 was sold to the Nippon Denchi Kabushiki Kaisha, when the Nippon Denchi Kabushiki Kaisha was organized, and I have been connected with the company ever since the company was organized. I have had no connection whatsoever with the Yuasa Chikudenchi Seizo Kabushiki Kaisha. As far as my knowledge is concerned the companies named in questions 7 and 8 have no connection with the Japanese Navy or any Departments thereof in or in connection with the improvements of submarine ac-

cumulators. I have known Engineer Commander Hikoschiro Miida when he was on the active list, but I have no knowledge of his whereabouts at present. I have no knowledge whatsoever of any approach made by Mr. Miida to Mr. Andresen, the representative of the Accumulatoren Fabric Aktiengesellshaft because in no way was Mr. Miida connected with me.

I know of Mr. Miida's visit to Europe prior to 1922, but I have no knowledge whatsoever of his doings in Europe. Mr. Miida has not been in my employment nor in the employment of any company with which I am connected.

FOURTEENTH CROSS-INTERROGATORY: Is it not a fact that prior to undertaking the manufacture of the product described in the patents in suit, more particularly in patent #1,584,150, you directly or indirectly approached or negotiated with the Accumulatoren-Fabrik Aktiengesellschaft for the acquisition of apparatus or plans of apparatus for making in Japan the materials for lead dust which the Accumulatoren-Fabrik Aktiengesellschaft used in the manufacture of its batteries?

ANSWER: On the 5th day of February, 1920, I was approached by the Ellis Company of Berlin on the apparatus referred to in question, but I was not interested in the matter, because of completion of my invention previous to this date.

Later, when I filed an application for German Patent on my invention, the German Patent Department sent a drawing of machine made by the Accumulatoren-Fabrik Aktiengesellschaft. The date of mailing of above drawing was May 11, 1925. This is the copy of above drawing (Fig. 18).

I started the manufacture of storage batteries right after the Sino-Japanese War in 1895. During

the Russo-Japanese War I sold my product for military use in Japan. Thereafter the demand for batteries increased. In order to meet this increased demand, it was no longer possible to depend on the raw materials supplied by others, because of lack of uniformity of product made from raw materials obtained from various sources. This necessity forced me to try some means of producing lead powder directly and quickly from the metallic lead. The experience and knowledge I acquired through long years of practice on the matter, required no knowledge from others nor the methods employed by others in Europe.

The porcelain pot-mill referred to is a machine used in crushing raw materials for chinaware, 6 inches in diameter and 10 inches in length.

The Nippon Denchi Kabushiki Kaisha does not engage in handling storage batteries made by others, but the Shimadzu Manufactory with which I also am connected, handles, since the beginning, all forms of apparatus, such as, machines of all makes, scientific apparatus used in laboratories, electrical appliances and X-ray sets made in foreign countries, including storage batteries for automobile use; naturally, we were the agent in Japan, representing such American company which deals in automobile storage battery. As has been said before the Import and Export Department of the Shimadzu Manufactory was once engaged in handling storage batteries, representing American concern for automobile uses. In 1918, we were the agent of Willard Storage Batteries Company of Cleveland, Ohio, U. S. A. I have not bought any storage batteries from the Accumulatoren-Fabrik Aktiengesellschaft. As I said in previous answer, I know of the construction of the machine used by the Accumulatoren-Fabrik Aktiengesellschaft because when I applied for German Patent, the German Patent Depart-

ment sent my a drawing of the machine but as to the lead ingredient or oxide used in the plates of storage batteries or process of same I had no idea. As has been mentioned before, the Shimadzu Manufactory represented the Willard Company of America from December 12, 1918 to June 28, 1934, in Japan.

The Shimadzu Manufactory handled batteries made by Leeds & Northrup but we were not the agent representing Leeds & Northrup in Japan, although vice-president Carey of Leeds & Northrup approached us on the matter of representing their product exclusively in Japan; we refused the offer. I did not meet Mr. Carey in Japan in the first instance for the purpose of discussing a proposed business arrangement between my company and Leeds and Northrup of Philadelphia. On account of my being the president of Company, it was merely incidental that I met Mr. Carey when he visited the Shimadzu Manufactory in Kyoto, Japan; although Mr. Carey talked on the subject to some of my men in the factory, I refused the offer. After the greeting, I talked to Mr. Carey about my invention on the lead powder and told him that this powder, if used in storage batteries, will greatly improve the general qualities of the batteries. Then he told me that he had a good friend in the biggest storage battery company in the United States of America. He said he will tell them and ask them to use my product, so I showed him my factory, explained to him about the apparatus and gave him a few circulars explaining the process and told him that if they wished. I will be glad to sell my patent right in the United States of America.

Mr. Luyho Ishimura was in my confidence in connection with the subject matter of my testimony and I disclosed freely and without reserve all details to him.

The United States Shimadzu patents were ob-

tained through the Nakamatsu Patent firm. The details of process were explained orally, therefore I have no drafts or memoranda or notes written in Japanese language.

SUYEHARU UCHIYAMA, a witness called on behalf of plaintiffs, having been first duly sworn, testified as follows:

Direct-examination.

My name is Suyeharu Uchiyama. I am forty-four years old. My present home address is 31 Koyamamoto-Machi Kamigyo-ku, Kyoto-shi. I am a member of Nippon Denchi Kabushiki Kaisha. I know Mr. Genzo Shimadzu and Mr. L. S. Ishimura. I have known them since the time I joined the Nippon Denchi Kabushiki Kaisha July 22, 1918.

Ever since I entered the Nippon Denchi Kabushiki Kaisha in July 22, 1918, I worked under Engineer Ishimura, who, under direct supervision of Mr. G. Shimadzu, was the engineer of the Nippon Denchi Kabushiki Kaisha. I was hired as a draftsman on July 22, 1918, by the Nippon Denchi Kabushiki Kaisha with which firm, Mr. Shimadzu was already then connected. As I said before, I entered the Nippon Denchi Kabushiki Kaisha on July 22, 1918, and worked as an assistant to Engineer Ishimura.

My routine work and duty was to make, trace or sketch drawings as directed by Engineer Ishimura. I have been making drawings of apparatus and machines used by Mr. Shimadzu in connection with the manufacture of storage batteries of the lead plate type and therefore, I have general idea of the work which has been carried on by Mr. Shimadzu.

FOURTH INTERROGATORY:

I remember the two drawings which Mr. Shimadzu had made very well because I actually saw Engineer Ishimura draw up plans for the construction of apparatus for making lead powder from lumps of lead in which revolving horizontal cylinder was used. The dates were sometime in September, 1918 and December, 1918. On account of the rule of the company, I cannot attach the original drawings. The attached are the correct photostats of the original drawings obtained through the courtesy of President Genzo Shimadzu (Fig. Uchiyama A) (Fig. Uchiyama B). The first drawing was planned, designed and traced by Mr. Ishimura, and I only blue printed the drawing; therefore, my signature is not on the first drawing. The second drawing was planned and designed by Mr. Ishimura, and I traced it on December 26, 1918; therefore, my signature, S. U. is on the drawing. Previous to the time the drawings were made, Mr. G. Shimadzu was working day and night on the problem of solving a method to produce the lead powder from metallic lead. In September, 1918, upon the completion of process, Mr. G. Shimadzu ordered Engineer Ishimura to make the drawings of apparatus on industrial scale. As I said before, the first drawing was made entirely by Mr. Ishimura, and I only did the blue printing. I actually saw him make the drawing some time during September, 1918. The second drawing, as I said before, was planned and designed Mr. Ishimura and I did the tracing on December 26, 1918. The two drawings were made by Mr. Ishimura under the direct supervision of Mr. G. Shimadzu and in blue printing and tracing above drawings, order was given me from Mr. Ishimura to do them quickly and secretly. The first drawing shows the important parts of revolvable iron cylinder, and the second drawing shows the revolv-

able iron cylinder equipped with 1.5 inch brass air pipe. Both drawings concerning machine for making the lead powder.

FIFTH INTERROGATORY:

There were sketches made by me previous to the two drawings referred to in the fourth interrogatory, based on the tests made by Mr. Ishimura under the direct supervision of Mr. G. Shimadzu. The first tests were performed on potmill made of porcelain; the next tests were performed on revolvable drum made of wood. General sketches of apparatus assembled were made as has been described in Mr. Ishimura's document "Investigations on making of Lead Powder". These drawings were designed by Mr. Ishimura under the direct supervision of Mr. G. Shimadzu and traced by me per instruction given by Mr. Ishimura. As has been said, I made or traced drawings per instruction given by Mr. Ishimura who performed tests under the direct supervision of Mr. G. Shimadzu. The drawings are in a document called "Investigation on making of Lead Powder" held by Mr. Ishimura. These are the correct photostats of the drawing obtained through courtesy of the President, G. Shimadzu (Fig. E). These drawings are the assembly drawings of the apparatus used for making the lead powder. Dimension and details are as shown on the drawing.

I knew of the apparatus based on these drawings being used for making lead powder, which in turn is made into paste to be used for the plates of storage batteries. I was working under Engineer Ishimura ever since I entered the firm and, by this reason, I was familiar with the above drawings. Consequently, I knew of the fact that machines were assembled according to the drawings (Fig. A & B). The apparatus based

on the first drawing was assembled in early part of November, 1918. The apparatus based on the second drawing was assembled in January, 1919, in the machine department of Shimadzu Mfg. The first and the second apparatus was used to make the lead powder for the plates of storage batteries. The first apparatus was operated in early part of November, 1918, and the second one was used in January, 1919, both dates being such as far as I remember. I did not know of the first test on the machine being performed because tests were carried on secretly, but in latter part of November, 1918, when I went to the lead powder factory to obtain some information on the drawing then being made, I saw a machine resembling that of the first drawing. I actually saw the apparatus, that is, the one equipped with air blower in operation in January, 1919. Lead balls about one inch in diameter were introduced into the machine through a feeder. I actually saw dark lead powder produced by this machine. The collecting mechanism of the first machine was an iron box installed under the revolving cylinder. The collecting process of the second machine was effected by the air which carried the product produced in the cylinder into the collecting chambers where it was deposited. The lead powder produced in the machine was used to make paste for the plates of storage batteries.

Ever since I entered the firm of the Shimadzu Manufactory in September, 1918 I have been working directly under Engineer Ishimura who, under the direct supervision of Mr. Shimadzu was working on a process of making lead powder from the metallic lead. As the result of Mr. Shimadzu's diligent research, the lead powder produced from metallic lead mechanically revolutionized the world's storage battery production. I was not connected in the detail part of the research, but I had a general idea of its dates and progress be-

cause I had made drawings concerning it under the instruction of Mr. Ishimura. Of the data and record shown in a document called "Investigation on Making of Lead Powder", held by Mr. Ishimura, I can swear and affirm to be the truth.

TOMINOSUKE HICHIJO, a witness called on behalf of plaintiffs, having been first duly sworn, testified as follows:

Direct-examination.

My name is Tominosuke Okamoto. My former name was Hichijo which I legally changed five years ago. My age is fifty-two years. My present address is 250 Hozuicho, Shiramori-Dori Shimodachuri-Agaru, Kamigyo-Ku, Kyoto-shi. I am foreman in the Nippon Denchi Kabushiki Kaisha. I know Mr. G. Shimadzu and Mr. L. S. Ishimura very well. I have known these men ever since I entered th firm in November 23, 1918. I have been working in the Nippon Denchi Kabushika Kaisha under Engineer Ishimura ever since my joining the firm. Mr. Shimádzu is the president of the company.

I joined the Nippon Denchi Kabushiki Kaisha on November 23, 1918. Mr. Shimadzu is the president of the company. I have been employed by Nippon Denchi Kabushiki Kaisha from November 23, 1918 to the present date, namely, 19 years. In the beginning I was a actory hand, working on the operation of mills.

I was an assistant to Engineer Ishimura in operating mills. I also worked on various experiments under the direction of Engineer Ishimura and Mr. Schimadzu. I operated the drum. I knew the apparatus was used to produce lead powder from metallic lead. The apparatus was intended to be used for producing

lead powder. The metallic lead balls were fed into the drum which was revolved. This apparatus was first completely assembled in early part of December, 1918. In the first apparatus which was constructed of iron cylinder, the lead balls were fed into the drum which was revolved. Through the opening in the drum, the lead powder produced was collected under the drum in a box. The powder produced was very coarse. Later, when the drum with pipe was used, the product obtained was collected through an air line and was very fine in texture. The dimensions of the drum were sixty inches in diameter and sixty inches in length, as far as I recall.

(At this point the Judge showed Mr. Okamoto the drawings Uchiyama A & B.)

FOURTH INTERROGATORY:

I have seen these drawings before. I saw the first drawing (Uchiyama A) in December, 1918, and the second (Uchiyama B) in the spring of 1919. The drawings are of the apparatus I operated as I mentioned before.

FIFTH INTERROGATORY:

I actually operated the apparatus made from these drawings referred to in the Fourth Interrogatory. I first saw the first apparatus operated in December, 1918 and the second sometime after January, 1919. I operated both apparatus in a branch factory of the Nippon Denchi Kabushiki Kaisha. I know of the raw materials used in that apparatus. They were lead balls about one inch in diameter; steel balls were sometimes used with the lead balls. I actually saw the lead powder produced by the apparatus. The product obtained from the first apparatus was coarse lead pow-

der, but the product obtained from the second apparatus was much finer lead powder.

I remember of the incident when Mr. Shimadzu found very fine lead powder piled up on the bearing bracket, and of the fact that he conceived the idea of using air current from this to separate the finer from the coarser lead powder. I also recall the incident when in the fine lead powder collected in a wooden box, a spontaneous combustion occurred.

UNITED STATES OF AMERICA
CITY COUNTY AND STATE OF NEW YORK } ss:
SOUTHERN DISTRICT OF NEW YORK

Wasuke Tanaka, being duly sworn, deposes and says that he is well acquainted both with the Japanese and the English languages, and that during the month of April, 1936, he translated the answers to the direct and cross interrogatories addressed to the witness, Genzo Shimadzu, and the answers to the direct interrogatories addressed to the witnesses Suyeharu Uchiyama and Tominosuke Hichijo in the above cause, from Japanese into English, and that his translation thereof is a true and accurate one to the best of his ability.

WASUKE TANAKA.

Sworn to before me this
14th day of May, 1936.
(SEAL)

STIPULATION.

(Filed April 19, 1937.)

Whereas, the respective parties in the above-entitled cause have separately appealed from the inter-

locutory decree of the United States District Court for the Eastern District of Pennsylvania entered in said cause on .

It Is Hereby Stipulated And Agreed by and between counsel for the respective parties as follows:

1. That the statement of testimony and evidence taken upon the trial of the above-entitled cause, in the condensed narrative form thereof hereto attached, may be approved by the Court, and, subject to the approval of the Court, become a part of the transcript of record to be certified to the Circuit Court of Appeals for the purpose of both appeals, lodgement of said condensed narrative statement in the Clerk's office and notice thereof and of the presentation thereof to the Court being hereby waived.

2. That subject to the approval of the Circuit Court of Appeals, the exhibits introduced upon the trial of said cause, susceptible of reproduction, may be omitted from the printed record on said appeals, said exhibits, however, to be submitted upon said appeals as physical exhibits in the form of five bound copies of reproductions thereof.

3. That the cost of preparation, certification and printing of the transcript of record to be certified to the Circuit Court of Appeals in connection with said appeals shall be divided and paid equally by the parties in the first instance, and thereafter adjusted in accordance with the taxable costs as provided by the mandate of said Circuit Court of Appeals.

RAWLE & HENDERSON,
EDWARD B. WHITCOMB,
HUNT, HILL & BETTS,
Counsel for Plaintiffs Appellant.

AUGUSTUS B. STOUGHTON,
E. S. W. FARNUM, JR.,
HUGH M. MORRIS,
Counsel for Defendant Appellant.

ORDER.
(Filed Apr. 19, 1937.)

And Now, To-Wit, this 19th day of April, A. D. 1937, the attached stipulation of counsel for the respective parties in the above-entitled cause having been presented to and maturely considered by the Court,

It Is Ordered By The Court as follows:

1. That the statement of testimony and evidence taken upon the trial of said cause, in the condensed narrative form attached to said stipulation, be and the same hereby is approved and said narrative statement shall be filed in the Clerk's office and become a part of the record for the purpose of both appeals.

2. That but one transcript of record on the appeal taken by the plaintiffs in said cause and the appeal taken by the defendant in said cause shall be certified to the United States Circuit Court of Appeals for the Third Circuit.

3. That pursuant to order of said United States Circuit Court of Appeals for the Third Circuit, the exhibits in said cause, susceptible of reproduction, shall be omitted from the printed record on said appeals and said exhibits shall be submitted on said appeals

as physical exhibits in the form of five bound copies of reproductions thereof.

W. H. KIRKPATRICK,
J.

OPINION

SUR PLEADINGS AND PROOFS.

(Filed October 5th, 1936.)

Before KIRKPATRICK, *J.*

SUR PLEADINGS AND PROOFS.

This is a suit in equity for the infringement of six patents, Nos. 1,584,149; 1,584,150; 1,584,151; 1,584,152; 1,584,479 and 1,896,020, all of which have to do with the production of fine powder of lead by the abrasion of larger pieces of metallic lead in a dry state. Various claims of the six patents cover process, product and apparatus. The claims in suit are, 1 and 2 of 1,584,149; 1-4, 6, 8-17 of 1,584,150; 1-5 of 1,584,151; all claims of 1,584,152; 1-4 of 1,584,479; and 10 and 11 of 1,896,020.

The product is used in the manufacture of plates for storage batteries. These plates consist of thin grids upon which lead paste is spread. The base of the paste is the powder, to which are added certain ingredients with which we are not concerned. It has been the experience of the industry that unless the powder is exceedingly fine and uniform in texture the paste will crack, peel or flake off from the grids when the battery is in use and thus shorten its life and impair its efficiency. The powder consists chemically of lead of which the greater part has undergone some degree of oxidation. The precise proportion in which pure lead and lead oxides appear in the mixture as well as the degree of oxidation are not important except as they effect its physical properties.

Until fifteen or twenty years ago, makers of storage batteries bought their powder. It was manufactured by various molten lead processes and consisted of finely divided litharge, red lead or other of the higher oxides. It was far from satisfactory, lacking the requisite uniformity and fineness. The necessity of purchasing it from others added to manufacturing costs. These drawbacks combined to make the matter of obtaining the powder a major problem in the industry. It can readily be seen that the development of a process by which makers of storage batteries could, without prohibitive expense of installation, produce in their own plants and in commercial quantities a thoroughly satisfactory powder would be of immense advantage to the industry, and it is not surprising that manufacturers in various parts of the world were spending a good deal of time and effort toward this end.

History of the Invention.

A brief account of the development of the process involved in this suit will be useful, not only in fixing the date of invention but also as a means of getting an understanding of its nature and the importance of its various elements.

Beginning about the middle of September, 1918, the plaintiff, Genzo Shimadzu, the largest manufacturer of storage batteries in Japan, and the head of many other industries, started experimenting with the idea that pieces of lead or lead balls could be abraded into powder by tumbling them together in a revolving vessel. He tried out, successively, porcelain vessels borrowed from the pottery industry, wooden drums, with and without metallic linings, vertical grinders of the mortar type, and a large specially constructed iron drum. He made a great number of trials during

September, October and November of 1918. Most of the product obtained was too coarse and irregular to be of any use; though some small amount of "hopeful fine powder" was observed. He also tried separating the fine from the coarse after the product had left the mill, by means of an air blast—which worked well enough but left the residue of coarse powder as pure waste.

Finally in December, 1918, he hit upon the idea of directing an air blast directly into the vessel in which the lead was being abraded, and a large metal drum was constructed with an inlet for the air current and an outlet by which the fine powder could be blown out. After some experimentation the inlet was fitted with a tube extending into the drum, having nozzles so that the air could be blown directly upon the abrading masses. This apparatus was completed and first operated in March, 1919.

It was at once observed that the amount of the product increased tremendously. This was a development of the greatest importance. The mere knowledge of some process by which the right kind of powder could be produced in trifling amounts was of very little value to anyone. The industry was looking for a way to make large quantities cheaply, and an invention which fell short of accomplishing that result would have been of academic interest only.

The increase in production was due to the fact that the air was an oxidizing agent, forming a brittle layer of oxidized lead upon the plastic surfaces of the balls, which easily abraded off leaving a fresh surface, upon which the process was continued until the balls were entirely pulverized.

It is possible that at that stage the plaintiff had no real appreciation of the importance of the oxidizing effect of the air current. He appears to have

thought that the removal of the dust was the principal cause of the increase in production. There was some ground for this belief, since it was not unreasonable to think that as long as the dust remained in the drum it would act more or less as a lubricant for the surfaces of the balls. But certainly, with the scientific resources and expert assistance at his command, he must have known that oxidation would be accelerated by the introduction of the air current. How much more than that he knew is hard to say.

Full commercial realization of the process did not follow immediately upon the installation of the mill in Shimadzu's plant (which was in June, 1919). That came only after more experimenting. Although some mechanical improvements upon the apparatus were made, most of this work had to do with the speed of revolution of the mill and the force and volume of the air current. What was actually being worked out, whether consciously or otherwise, was a second and highly important element of the process, namely, temperature control. Production in satisfactory quantities depended upon abrading the balls to powder as rapidly as possible and that in turn depended upon determining and maintaining a temperature in the mill which would be high enough to produce rapid oxidation but not so high as to melt the metal or to over-oxidize the product. The mill was large enough to be used commercially, and the plaintiff's witnesses referred to this period as "industrial scale experimental research". It was carried on from June, 1919, through the spring of 1920. Long before its termination, successful operation was so assured that it was decided to build a plant solely for the production of powder by the new process. The construction of the new plant was started in April, 1920, was completed in June of the same year, and went into regular operation about that time.

I fix the date of invention and successful reduction to practice as not later than August, 1919, that being the date of the "powdering machine" having the construction shown in Figure 28 of Ishimura's notebook. Whether or not the plaintiff, even then, fully realized the chemical reaction which made his process a success is beside the point. He certainly knew by that time that, subject to working out of details, he would be able to obtain large quantities of a satisfactory product. That was his major interest as well as that of the industry. A research scientist would, undoubtedly, have centered his attention upon the chemical reaction involved, but Shimadzu was a practical commercial operator, and I think it clear that he had enough appreciation of what was necessary to obtain the desired result for me to fix the date of invention at or before the time referred to, which is all that is necessary for the purposes of this case.

The process was unquestionably invented when the idea of blowing an air blast into a rotating mill in which lead pieces were being abraded and keeping the whole at a controlled high temperature by means of regulating speed of revolution and air pressure had been evolved and successfully practised, and this point had been reached well with the time fixed.

The Process Claims of the Patents, Particularly '150.

At this point it will be convenient to summarize the process claims of the American patents postponing discussion of the product claims until later.

The important patent is 1,584,150. Some of the process claims of this patent define the thing which the process produces as "a fine powder of lead suboxide intermingled with powdered metallic lead (claims 1, 2, 3, 4, 6 and 8). The remainder define it as a finely divided powder containing a large proportion of oxidized

lead without any mention of lead suboxide, (claims 9, 10, 11, 12 and 13). Claim 7 is not in suit. Passing over the first group ("suboxide" process claims) for the present, claim 9 is typical of the second group. It calls for the following steps:

1. Impinging a current of air on lead masses in a dry state;
2. Abrading the lead masses;
3. Controlling the temperature to obtain a finely divided powder containing a large proportion of oxidized lead.

Claims 10 and 13 fix the necessary temperature at above 60 degrees centigrade.

Claim 2 of '149 is another process claim of this type, referring to "a finely divided chemically reactive lead powder of such fineness and activity as to be readily changed chemically on exposure to air". The air current is introduced into the vessel for the purpose of removing the powder formed by attrition of the lead masses. This patent contains no suggestion of the oxidizing effect of the air, or of temperature control.

The '151 patent carries on the process of '150, and deals with the further oxidation of its product to form higher oxides such as litharge and red lead. This patent really belongs with the product claims, since its process begins with a lead suboxide powder. It stands or falls with the product claims of '150.

'152 has to do with paint and depends on the product claims of '150 rather than the process.

'479 relates to the preparation of the plates for storage batteries, mixing the product obtained by the earlier patents with various liquids.

The '020 patent is for the apparatus.

In all the process claims of '150 in suit the essence of the invention claimed is accelerated abrasion by oxidation of lead surfaces by air blast and regulated temperature.

THE JAPANESE PATENTS.

In November of 1920, the plaintiff applied in Japan for a patent which was later issued to him as Patent No. 42,563. Both before and after that time he also applied for other Japanese patents, but '563 is the only one which need be considered in this connection. The application date was more than a year before the plaintiff filed his application for U. S. '150 or, for that matter, for any of his American patents, and therefore R. S. 4887 would invalidate the American patents if the latter are for the same invention.

The law, as laid down by the Circuit Court of Appeals for the Third Circuit in Altoona Publix Theatres vs. American Tri-Ergon Corporation, 72 Fed. (2d) 53, is that where the defense is in invalidity under R. S. 4887, the question is not what was disclosed, but what was claimed in the earlier patent. The language of the statute makes it clear that it is the patenting of the invention which is material, and it is the claim, not the disclosure of the specification, which determines what has been patented. In the opinion referred to, the Court said, "There are many features disclosed in the German Patent which are not claimed, and in law the patent stands as though the features were not disclosed." The foreign patents and the American must be identical (Leeds & Catlin vs. Victor Talking Machine Company, 213 U. S. 301) and a heavy burden of proof rests upon the defendant to show that they are. General Electric Company vs. Alexander, 280 Fed. 852.

Claim 1 of the Japanese Patent, No. 42,563, is as follows:

"In order to achieve the object recorded earlier in this record, a method of manufacturing chemically reactive lead powder is claimed, a special feature of which is throwing lumps of lead into a rotating vessel, and blowing currents of air or other inactive gases into the vessel during rotation to force the small particles produced by rubbing out of the vessel."

The other claims are like enough to the first to require no separate discussion.

Is this a claim for the invention patented in U. S. 150? I do not think that it is, and when the whole disclosure of the Japanese patent is read carefully that conclusion is fortified. The first thing that strikes one is that there is not the slightest suggestion of any oxidizing effect of the current of gas which is introduced into the mill. On the contrary, it would seem that there was a definite purpose to avoid oxidation. The patent has to do with the purely mechanical step of removing the lead powder from the rotating vessel. It almost looks as though the patentee feared that, in the course of removal, oxidation would take place and provided, according to his lights, against it. For example, he points out that powder produced by the process of an earlier patent (which provided no means for its removal) is likely to ignite spontaneously, due to the heat of friction inside the mill. "But this defect he says "is . . . eliminated by the present invention, by blowing in air or some other inactive gas with a resultant cooling effect." Obviously, the teaching of the patent is that the mill should be operated at as low a temperature as possible.

The cooling and conveying medium is described in all the claims as "air or other inactive gases". This is a flat contradiction in terms. An inactive gas is one which has no oxidizing effect on other substances. Air, containing about 21% oxygen, is an active gas.

It is certainly an extraordinary thing that the plaintiff should have been unaware of this but, nevertheless, the use of the word "other", read in the light of the object of the patent as disclosed in the entire specification, leaves no doubt that he mentioned air as an example of a convenient inactive gas. The best guess that one can make of what he had in mind was, that he meant to patent a process for mechanically removing fine powder from the drum by means of a current of some non-oxidizing medium, and that he believed that air with its high percentage (78%) of nitrogen, if delivered at a low temperature, would be sufficiently inert to serve his purpose and prevent combustion within the drum. It is scarcely necessary to point out how completely this misses the invention described in the American patent, which depends primarily upon the initial and continuous rapid oxidation of the surfaces of the metallic lead, accomplished by the air blast, the regulation of the heat and of the amount of oxidizing gas all being directed to obtain this reaction to the maximum effective degree.

Besides this, if the Japanese patent has been correctly interpreted as a disclosure of the use of a non-oxidizing medium, it is invalid, regardless of what it attempts to claim, because the process is perfectly useless and inoperative. It was demonstrated conclusively both by witnesses at this trial and by Ishimura in the course of his efforts to develop the process, that, if lead balls are rumbled together in an inert atmosphere, the result will be nil. The balls will simply polish one another and not an ounce of powder will result.

But the defendant argues that, even if the claims do not cover the American patent and R. S. 4887 does not apply, the unclaimed disclosure of the use of an air blast upon the abrading lead masses was dedicated

to the public or anticipates as a foreign publication. In order to get even a starting point for this argument it is necessary to omit the word "other" wherever it occurs in the phrase "air or other inactive gas". If this is done (and I do not see how it can be) the best case that can be made out for the defendant's theory is that the disclosure suggests two inconsistent, and mutually exclusive methods, one of which may lead to a useful result if understood and further developed by temperature control, and the other of which leads to nothing. A disclosure of this kind cannot operate either as an anticipation or as a dedication of anything to the public. A patent, like any other instrument, may be of doubtful meaning or it may contain several meanings applicable to varying conditions but it cannot have two meanings inconsistent with each other. See Kintner vs. Atlantic Communication Company, 240 Fed. 716, 720. "A document so obscure in its terminology that two conflicting theories may be deduced therefrom and supported by equally plausible arguments is too indefinite to be utilized as an anticipation." Cimiotti Unhairing Company vs. Comstock Unhairing Company, 115 Fed. 524.

If this patent (amended to suit the defendant's argument by striking out the word "other") were placed in the hands of a person skilled in the art, with instructions to inaugurate the process, he could but guess as to which method to use. As a matter of fact, he would be more than likely to confine himself to nitrogen or some inert gas, because the patent seems to imply that an active gas might be detrimental; and he might spend an indefinite period of experimentation and even have to exercise truly inventive qualities before he ever reached the point of using an oxidizing medium.

But the foregoing discussion is perhaps unneces-

sary. The patent cannot be read as a disclosure of alternative processes. It must be interpreted with a certain amount of common sense and regard for its plain objects. The last thing it intended to teach was the use of an oxidizing agent. When air was referred to, it was as an example of a non-oxidizing gas, and to say that this incidental and erroneous use of it amounts to a disclosure or dedication of something which the patent obviously meant to steer clear of is going very far out of the way to destroy the American patent.

For whatever it may be worth, it is pretty clear that the plaintiff himself did not understand that, when he applied for Japanese '563, he was taking out a patent on the same process which appears in U. S. '150, because subsequently, in Japan, he took another patent, No. 60,825, which corresponds very closely with U. S. '150, and, being within the year, does not invalidate it. We are not concerned with the motives which prompted him, in taking out the '563 patent, to confine it to the single step of mechanical removal of the dust from the drum, and to withhold the really essential steps of the invention for later patenting. It is sufficient to say that he had the right to do this if he chose.

Alleged Prior Public Use.

The Activities of the Defendant and the Tudor Mill.

Since about 1900, the defendant has been engaged in manufacturing storage batteries in the United States. It originally bought its lead powder and was having the same difficulties keeping up the quality of its battery plates and in reducing production costs as the plaintiff found in Japan. Like the plaintiff, it was looking about for some way of manufacturing its own lead powder and improving it in order to meet the exacting requirements of its trade. At an early

date it had imported some red dust from A. F. A., a large storage battery manufacturer in Germany, with whom it had an arrangement for exchange of technical and engineering information.

In 1907, one of the defendant's engineers observed the operation of an apparatus known as a Tudor mill in the German plant, and brought back a report about it. In 1912 he again visited and again reported. Finally, in July, 1915, the defendant bought a Tudor mill duplicating those seen by their engineer in Germany and set it up in its plant, putting it into operation about the middle of 1916. The engineer who had been in Germany turned over to the official in charge of the mill all the information which he had obtained about it. Various runs were made for the purpose of obtaining a product and in 1917 and 1918 batteries constructed from the powder were sold to New York Railways Company. The first order was for 70 sets of batteries at a price of $65,000 comprising some 16,000 plates. A second order was for about a fifth of that amount.

About the middle of 1918 however, the mill was dismantled (the plaintiff says "junked") and sent out to the Willard Storage Battery Company in Cleveland—a concern controlled by the defendant. It was not operated at the Willard plant until May, 1920, but shortly after that date some runs were made and a comparatively small quantity of lead powder was produced which was used in regular production of plates. Then the mill was dismantled again and shipped back to the defendant in Philadelphia where it was stored until it was finally disposed of as scrap metal.

While it is true that the orders of the New York Railways Company were not repeated and that the commercial production at the Willard Company was unimportant, and while there was undoubtedly a great

deal of experimental work being done with the mill all through these operations, I cannot agree with the plaintiff that the whole incident must be dismissed as an abandoned experiment. Certainly it was not a great success, as can be seen from the bare recital of the facts about it. There is nothing to indicate that the product was not satisfactory, but the mill never produced powder in sufficient quantity to justify its continuation in commercial use. Nevertheless, I think it might stand as a prior public use against the plaintiff's patents, provided it really anticipated the plaintiff's invention—a question which will be considered later.

In July, 1920, the defendant set about installing a full-sized plant for the manufacture of lead powder at Philadelphia. Mr. Hall was engaged for that purpose. No powder had been produced at the Philadelphia plant since 1918. Hall had complete plans of the German Tudor mill together with engineer's reports and notes and the records of its operation in Philadelphia, but attempted no further development along that line. Instead, he decided upon what he referred to as a "radical change" from the German mill. As a matter of fact, he discarded it altogether and proceeded to install an entirely different type, which embodied the plaintiff's principles and in which the principal element was a Hardinge conical mill. He "recognized that means must be provided for admitting air into the interior of the mill" and proceeded to do so. He also, by this time, understood that temperature control was an important part of the process if quantity production was to be obtained. The defendant's engineer testified "As the mechanical equipment of this installation was perfected, it developed that a Hardinge mill made possible a very wide and different control of product. The primary element entering into

the control proved to be: Amount of air admitted to mill. Temperature of the interior of the mill. Lead within the mill. . . . It became evident at once the Hardinge mill was started that a different flow of air through the mill must be provided . . .". To "standardize" the quality a great deal of experimenting by the research department was required, which continued after the mill was set up. Referring to the date of June, 1921, the witness testified "As the main principles of operation were now understood . . .". The mill was installed early in 1921 and was not in commercial production until some time after April 22 of that year.

In 1923 the present plant was erected and four Hardinge mills installed and in July of that year large scale commercial production continued. Commercial production by the Hardinge mill with its forced air draft undoubtedly involved the use of the plaintiff's patent, and June, 1921, may be fixed as the date when that began.

To return to the Tudor mill. Regardless of the lack of commercial success with this, I am of the opinion that it cannot be considered as a prior public use against the patents in suit, because its entire operation failed even to approximate the essential idea of the plaintiff's process patent. If it is a mere question of a literal reading of the patent, it may be possible to find in the Tudor mill process the bare elements of the plaintiff's patent, but if the method of operation be carefully considered it will be seen how far away from the spirit it is. The essence of the plaintiff's patent, as has been already seen, is forcing a continuous blast of air into the drum at a controlled high temperature so that oxygen will be absorbed by the lead and form a brittle oxidized surface which could be rapidly abraded off. Now, in the Tudor mill, the

whole surface of the drum was perforated with a great number of eighth inch holes. The drum was surrounded by a fine mesh cylindrical screen and this in turn by an outside iron casing. A certain amount of air of course got into the drum through the casing, and a moderate draft was established, apparently to prevent it getting too hot, by putting a stack at the top of the casing and a small vent pipe with a damper at the bottom. That was all. There was absolutely no suggestion or thought of blowing or forcing the air into the drum. As a matter of fact, the broken and powdered material lying against the perforations in it must have kept a great deal of the circulating air out. The defendant never had the slightest conception of the effect which even this gentle circulation of air had upon the lead surfaces to be abraded. The correlation between oxidation in the drum and increased yield was not perceived. Its engineer considered that the only really important oxidation that took place in the lead powder was after it left the drum and as it descended by gravity in the casing into the kegs to be filled. Naturally, there was no thought of temperature control to get the maximum degree of oxidation in the drum. The results were about what would be expected. The amount of product obtained was very limited and the mill simply did not solve the problem or meet the requirements of a commercially useful process. It was abandoned.

Both the plaintiff and the defendant had been confronted by the same industrial difficulties. Both were groping for a way of overcoming them and both reached a satisfactory result. There is no evidence—nothing more than a suspicion—that the defendant's abandonment of the Tudor mill and its adoption of the process of the plaintiff was caused by anything learned at the plaintiff's mill in Japan. It does not

detract from the quality of the invention that it was reached independently by another in a distanct part of the world. On the contrary, the fact that different streams of inventive effort had for years been directed toward the same end, goes to show the importance of a successful outcome to the industry.

THE HALL-SHIMADZU INTERFERENCE.

In 1924 Mr. Hall filed an application covering the process which had been developed in the defendant's plant. The plaintiff's applications for his American patents had been filed during the years 1922-1924. While the Hall application was pending, Shimadzu's patent '150 issued. Hall believed the processes of the two applications to be identical, added claims 2, 3, 4, 6, 14, 15, 16 and 17 of Shimadzu to his application, and interference was declared. The Law Examiner held that claims 9 to 13 Shimadzu (process claims not referring to lead suboxide) were unpatentable. As to the other claims, the Board of Appeals for the Patent Office awarded priority to Shimadzu, and this decision was affirmed by the Court of Customs and Patent Appeals.

I do not think that this phase of the case deserves quite the importance which the parties have given it, or that it is necessary to go in detail into the testimony before the tribunals of the Patent Office, or into the reasons for its decision stated by the Court of Customs and Patent Appeals. The sole issue determined, and the only point as to which those proceedings are res judicata, is that, whatever Hall may have done, he had not made the invention of Shimadzu's '150 patent prior to the time when Shimadzu made it. Upon this issue the burden lay upon Hall to establish that he was the prior inventor, and this burden the Court held that he did not sustain. It was the only

question which the tribunals of the Patent Office had jurisdiction to decide. The interference proceeding and this infringement suit are not based upon the same cause of action, and in such case the law is well settled that only those questions actually decided in an earlier suit are res judicata in a later one. Troxell vs. Delaware, Lackawanna & Western Railroad Company, 227 U. S. 434.

The record in the interference was relevant only as it affected the value of the testimony given by the witnesses who testified in both cases. In the earlier proceeding Hall had asserted that his process was capable of producing, and did produce, the product of Shimadzu's '150. Ishimura, who had not seen it in operation, but who had painstakingly set up a duplicate mill, had testified that it could not possibly do so. Both witnesses, when called in the present case, were compelled to explain a number of embarrassing inconsistencies—an ordeal which, I think, both went through as gracefully as possible under the circumstances. Otherwise, the interference proceedings do not require extended consideration.

PRIOR ART PATENTS.

The defendant has cited a number of prior patents against the patents in suit, with particular reference to '149 and '150.

The plaintiff is undoubtedly entitled to rely for priority upon the date of invention and reduction to practice as found, regardless of the fact that the invention was made in a foreign country. Claude Neon Lights, Inc. vs. Rainbow Light, Inc., 47 Fed. (2d) 345. Hanover vs. E. H. Godshalk Company, 78 Fed. 811. This eliminates from consideration the Belgian Tudor Patent, No. 239,406, Thibault French Patent, No. 494,270 of September 4, 1919, and one of two others.

Of those remaining, only Bailey U. S. Patent, No. 846,384, requires extended consideration. The Thibault patent, supra, will however be discussed because its date is so very close to the date of invention.

As to these patents, as well as all the others cited by the defendant, the general observation may be made that in a great industry, with unlimited capital and expert knowledge of the highest type at its command, endeavoring for many years to reach a solution of a serious problem, they made not the slightest impression. To draw the conclusion from this that they were wholly inoperative would be perhaps going too far. But, whatever the reason, it can be safely said that they somehow missed the mark—a fact which must be borne in mind when their disclosures are considered as prior art.

In Bailey's patent, a cylinder is equipped with mechanical beaters or paddles and into it is fed lead already in a rather fine state of division. It is stated in the specification that molten metal may be first blown by air or steam to a suitable degree of fineness. The device is clearly intended to begin its operation upon lead already in the form of a powder. Certainly the exemplification of the apparatus given in the specification would not work upon any other type of material. The beaters reduce the coarse powder to a finer state and a current of air is used to remove the fine product after it is produced. No doubt oxidation takes place in the course of the procedure, and the final product may well be very similar to that of the plaintiff's patent.

But there is no suggestion whatever of the oxidation of the lead masses to produce a large quantity of product by their rapid and complete abrasion acting upon themselves, and without other mechanical means. Bailey's final product is only in a very remote degree

the product of abrasion. True, he throws in the suggestion that ". . . it is possible that the product may be produced in many ways, as by a grinding or abrading process," but this casual reference is too indefinite to amount to an effective disclosure. It may, and probably does, mean preparing the metallic lead for the mill by the use of grinding stones, filing machines or other abrasive devices. If it is intended as an alternative to the entire process, then it contains no suggestion of the air blast. At all events, it is entirely too indefinite to amount to an anticipatory disclosure of the vital principle on which the plaintiff's process is based. From the fact that the air is introduced halfway up the cylinder, and sucked out at the top, it looks as though Bailey felt it undesirable that the air should do anything other than carry out the fine dust. The abrasion which would take place among the grains of coarse powder as they were agitated by the beaters would be entirely negligible in obtaining the quantity production which is, after all, the object of all these processes.

Thibault puts his material into a cylindrical vessel and simply cooks it—an operation which he assists by blowing compressed air and steam into the vessel, which might well be called a kiln. It is a closed vessel and the combined steam and air pressure is regulated by a needle valve. Again, the material preferred is lead in granulated form, which suggests preliminary treatment of some kind to reduce it to a suitable degree of fineness. Some fine particles escape through the valves and are collected, but the bulk of his final product is what remains in the vessel after the process of oxidation is completed.

The vessel may be, but does not have to be rotatable. It would not be too much to say that Thibault not only fails to utilize abrasion of the oxidized

masses in order to get a mixture of lead and an oxide of lead but rather definitely excludes it. The complete oxidation of his material was the thing that he was primarily trying to obtain. Any metallic lead in the final product was plainly an undesirable by-product. As in Bailey, the basic principle of the plaintiff's patents is ignored. Finally (a matter of immense practical importance) the process cannot be carried on continuously, since at the end of a seven or eight hour period, the entire charge of metallic lead has been converted into oxide, and the mill must be stopped and cooled and the charge removed before it can be reloaded. This fact alone, necessarily reducing the production to a small fraction of that which can be obtained from the plaintiff's process, would put the device out of the field as an anticipation of the plaintiff, and possibly accounts for its failure to make any impression.

The Product Claims.

Claims 14, 15, 16 and 17 of '150, and claims 1 and 2 of '152 are for the product. They all describe the powder as composed in part of lead suboxide. Claim 17 of '150 may be taken as typical. It is:

"As a new composition of matter, a highly chemically reactive powder, comprising a large portion of lead suboxide, said powder being capable of spontaneous reaction on contact with air."

With regard to these claims the defendant's position is that lead suboxide is a purely hypothetical substance which has no actual existence, and that, therefore, the claims are invalid or if valid are not susceptible of being infringed.

Lead suboxide, according to the plaintiff's theory, is a chemical combination, the molecular structure of which is two atoms of lead combined with one of oxygen. Its symbol is Pb_2O.

Quite a number of higher oxides of lead have been identified, and are now well known to science. The existence of Pb_2O, however, is not, at the present time, accepted as a scientific fact. There are eminent authorities who affirm it, and others, equally worthy of acceptance, who deny it. The entire matter may be said to lie in the realm of controversy.

The plaintiff concedes that the substance is of a fugitive character, rapidly transformed into a higher oxide in the atmosphere, difficult to segregate, and not susceptible of identification by an ordinary method of chemical analysis. Within the last quarter century, however, there has been developed a method of analysis by use of the X-Ray grounded upon the basic crystalline structure of certain substances, various forms of crystals being represented by certain arrangements of imaginary points and lines known as space lattices and the structure of the substance under examination being identified by referring its X-Ray spectrum or diffraction pattern to calculated patterns of the space lattices. Using this method as his principal support, the plaintiff's expert testified to the existence of the lead suboxide as a chemical compound, and to its presence in the product of the defendant's mill. Using the same method, the defendant's experts reached a diametrically opposite conclusion.

Upon this issue thus presented, a very large amount of extraordinarily interesting testimony was taken. I shall not attempt to do more than briefly comment upon it, and state my conclusion.

Berzelius, about a century ago, prepared a black powder containing lead by igniting lead oxalate in a vacuum. This product was highly reactive and took fire spontaneously in the air. Having analyzed it, he gave it the name lead suboxide, owing to the fact that

it contained less oxygen than lead monoxide, commonly known as litharge. For almost a century this substance has been described in textbooks and handbooks as lead suboxide. However, rather recently its existence came to be regarded with a certain amount of skepticism, a few chemists believing it to be merely a mixture of finely divided lead and lead monoxide.

I believe that the plaintiff concedes that the experiments of Berzelius could not have produced lead suboxide, in the proportion in which Berzelius believed that he found it, and, if at all, only in very minute quantities.

In 1926, Ferrari published the results of an X-Ray examination of a sample of so-called lead suboxide of Berzelius. He claimed to have found lines in the X-Ray spectrum of this substance which indicated the presence of Pb_2O. Subsequently, at least two other scientists repeated Ferrari's work and were unable to duplicate his results. Consequently, they drew the conclusion that Ferrari's original data were in error and that there was no evidence for the existence of lead suboxide in the black powder of Berzelius. Despite these publications questioning the validity of Ferrari's experimental work, there has come from his laboratory no additional paper containing evidence in confirmation of his original data.

Dr. Davey and Dr. Anderson, the experts for the defendant, both well known workers in this particular field, have examined by the X-Ray method of analysis samples of the defendant's product and have been unable to find any evidence for the existence of suboxide in either it or in samples of black oxide prepared according to the directions of Berzelius.

Dr. Clark, the plaintiff's expert in this case, an outstanding authority upon laboratory technique, examined similar samples of the defendant's product

and of the black oxide of Berzelius and testified that he found some lines which correspond very closely with Ferrari's pattern. He also by means of a supercentrifuge separated from the defendant's product some very finely divided material which he claimed to be nearly pure lead suboxide. In substantiation of this he made a chemical analysis of the product and states that the percentage of lead corresponds fairly well with that required by the formula of lead suboxide, Pb_2O.

Against these conclusions, it was pointed out by Dr. Davey with much force that, inasmuch as pure Pb_2O has never been segregated, there is no existing X-Ray pattern for it and that, consequently, the conclusions of Dr. Clark are only warranted if the calculated or hypothetical lattice for Pb_2O is actually the correct one. It is also true that the percentage of lead, as reported by Dr. Clark from his chemical analysis, while it happens to correspond to the theoretical demand of Pb_2O, does not by any means prove that Pb_2O is actually present, since the same percentage might be given by a mixture of lead and lead monoxide.

Without questioning either the accuracy of Dr. Clark's experimental data or the sincerity of his rather guarded conclusion, or that of the much more positive opinions of the defendant's experts, my verdict must be "not proven" as to either the existence or non-existence of the questioned substance. Such a verdict is, I believe, in accordance with the general position of scientific thought upon the question today. It would be little short of absurd for me to make a definite fact finding in a field in which science itself has arrived at no generally accepted conclusion, and I shall not attempt to do so.

This recalls us to the fact that we are engaged in

the determination of a dispute between two parties in a court of law, rather than in an excursion into the realm of scientific research, and we must approach the question from the standpoint of the rules which the law has established for resolving the controverted issue. The patent is by reason of its issue presumptively valid and the burden of proof is upon the defendant to show its invalidity. I am unable to find as a fact that lead suboxide does not exist. The burden has not been met, and the product claims are therefore held valid.

On the other hand, the burden is upon the plaintiff to prove infringement. He has not established the fact that suboxide is to be found in the defendant's product and so has failed to meet the burden. I therefore hold that the claims above referred to are not infringed.

THE "SUBOXIDE" PROCESS CLAIMS.

These are claims for the process, in which the product is incidentally described as containing lead suboxide. They are claims 1, 2, 3, 4, 5, 6 and 8 of '150, claim 1 of '149, the 7 claims of '151, and the 4 claims of '479. The considerations which apply to them are quite different from those which I have stated in connection with the product claims.

In these claims what was primarily intended to be covered was a method of producing in commercially useful quantities, a lead powder of such fineness and uniformity as to make it satisfactory for battery plates.

Undoubtedly, the adoption of the term, lead suboxide, by the plaintiff to describe one of the constituents of his product was due to the fact that under certain conditions it was of low oxidation and almost black in color. Anyone in his position in, let us say 1920, consulting a standard chemical dictionary would

probably feel justified in drawing the conclusion that he had in his product a large proportion of this black oxide of Berzelius. At least he would find numerous statements in textbooks justifying his use of that term. It might be pointed out in this connection that X-Ray analysis was not applied to an examination of the black oxide of Berzelius until eight years after Shimadzu undertook his first experiments.

Now it is well established that even in product claims an inventor is entitled to considerable latitude in his definitions, and may to a large extent define the product in his own terms. A fortiori, where the invention is for a process for obtaining a commercial product in which the physical rather than the chemical qualities are the important thing, he will not invalidate his patent because in naming the product he has adopted a term, well recognized by the scientific world, which later turns out to be of doubtful accuracy. The patent law is not concerned with abstract scientific principles, but with the means of usefully employing processes, apparatus, etc., which may result therefrom. As observed by Mr. Justice Holmes in Minerals Separation vs. Magma Company, 280 U. S. 400, 403, ". . . no one concerned in this business would care a straw as to the intimate nature of the action if it produced the result".

From what has been said, it follows that, as to these process claims, infringement may be found if the process covered is used by the defendant, even though it is impossible to prove that the product manufactured by the defendant contained lead suboxide. Where the product claims are the only things in issue, suboxide is necessary to their validity over the prior art, since small quantities of a powder having generally similar physical characteristics had undoubtedly been produced before, and consequently infringement

cannot be found without proof that lead suboxide exists in the accused mixture. But where the question is the use of a commercial process to obtain a product in quantity and the description of the product is more or less incidental, it would be more than unfair to deny the inventor the rights to which he would be otherwise entitled because of a misdescription.

What has been said may be taken as applying to the suboxide process claims of '149 and '150. The five claims in suit of '151 and the four claims of '479 are process claims but they stand upon a slightly different basis. They begin with the product of '150 and treat it in order to produce something different. In every case this initial product or element of the process is described as being or containing lead suboxide. Now, as has been held, it will not necessarily invalidate a process that its final product is given a name which is scientifically incorrect. But in these claims the use of the described powder is the first and vital step of the process. It is the suboxide constituent which gives them novelty over the prior art. Therefore they really stand with the product claims—presumptively valid but in the present state of scientific knowledge not susceptible of proof of infringement.

Patent '149 and Double Patenting.

Patent '149 claims a process for the formation of lead powder by abrasion of masses in a rotating vessel plus "removing said powder from said vessel by means of" a current of air (claim 2). This patent is not invalidated by Japanese patent '563 for reasons already given in connection with that patent. The erroneous use in the Japanese patent of air as an example of an inert gas is not sufficient to make it identical with a patent which claims the use of air and nothing else.

Whether or not '149 is for the same process as U. S. patent '150 is immaterial, so far as the question of validity of either is concerned. There is no double patenting involved. The two patents issued on the same day. They both expire on the same day. There can be no extension of the monopoly and one is not prior art against the other.

The fact that '149 does not disclose the oxidizing function of the air or refer to the highly important element of the process having to do with the temperature control necessary to its successful operation might throw doubt upon its validity in view of the prior art. This is, of course, upon the assumption that it is not for the same invention as '150. The whole matter however is rather academic since '149 is coincident in duration with '150, and the defendant's process infringes the somewhat more precise, if not narrower, claims of '150.

This patent is therefore held valid and infringed.

Infringement of Process.

There can be no question that the process used by the defendant is substantially the same as that of the plaintiff's patents. In fact it is almost identical. As a fact finding upon this point the report of Dr. Wilson, an independent expert appointed by the Court who made a complete study of the defendant's operation at the Crescentville plant, is adopted by reference.

Apparatus.

The apparatus patent (020) is closely related, of course, to the process patents. Practically all the considerations which apply to the one apply to the other, including the Tudor mill and other alleged prior art structures. Having held the process claims valid and

infringed, the same conclusion is reached with regard to the apparatus patent.

CONCLUSIONS.

Claims 1 and 2 of patent 1,584,149 are valid and infringed.

Claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of patent 1,584,150 are valid and infringed.

Claims 14, 15, 16 and 17 of 1,584,150 are valid but not infringed.

Claims 1, 2, 3, 4 and 5 of 1,584,151 are valid but not infringed.

Claims 1 and 2 of patent 1,584,152 are valid but not infringed.

Claims 1, 2, 3 and 4 of 1,584,479 are valid but not infringed.

Claims 10 and 11 of patent 1,896,020 are valid and infringed.

The statements of fact contained in the foregoing opinion may be taken as special findings of fact and the statements of law may be taken as conclusions of law under Rule 70½.

Decree may be submitted.

MEMORANDUM AMENDING OPINION AFTER REHEARING.

(Filed Nov. 20, 1936.)

Before KIRKPATRICK, *J.*

The plaintiff has presented a petition for a rehearing requesting that the Court reconsider two statements or findings of fact, appearing in the opinion. These statements relate to the time when the defend

ant began to use the process of the plaintiff's patent. That use began some time after the installation by the defendant of a Hardinge mill in its plant.

The statements referred to are the following:

1. "The mill was installed early in 1921 and was in commercial production during the entire year. especially the latter part."

2. "Production by the Hardinge mill with its forced air draft undoubtedly involved the use of the process of the plaintiff's patent, and January, 1921, may be fixed as the date when that began."

As to the first of these, the statement that the mill was in commercial production during the entire year is obviously wrong. It was shipped from New York on January 7 and could hardly have been set up and started before the middle of the month at the earliest. There is no evidence of anything approaching commercial production earlier than April 22. Smith's testimony was that "as soon as the Hardinge mill started to produce lead dust in quantity, this material was made into plates, which were then tested by the laboratories". The earliest written evidence relating to the plates was Exhibit 68 dated April 22, 1921, instructing the Superintendent's department to make certain plates for testing. On Smith's testimony therefore production "in quantity" could have begun about that time, but not substantially earlier.

I shall therefore eliminate the first statement above referred to and change the sentence to read "The mill was installed early in 1921 and was not in commercial production until some time after April 22 of that year".

As to the second statement of fact, it may be said at once that it was never intended by the Court to make

a finding of a prior public use (in the statutory sense of that term) by the defendant in January, 1921. Indeed, it is really very doubtful whether the defendant was using the plaintiff's process at all in that month. When the mill started, which as has been seen could not have been earlier than the middle of the month, there was no provision for any air blast. The only testimony as to when such provision was added is that of the defendant's witness who said "It became evident at once the Hardinge mill was started, that a definite flow of air through the mill must be provided and for this purpose a small blower, that happened to be on hand, was installed". It might be inferred that the blower was installed soon after the mill was started, but there is nothing whatever to show how soon. It might have been a day, a week or a month. The blower proved insufficient and a new blower was purchased on May 5. If the insufficiency of the small blower was such that it would be evident shortly after its installation, then it might be argued with much force that it had not been in use very long before May 5.

At any rate, the most cursory reading of the testimony of the defendant's witness Smith will show beyond question that for a very considerable time after the installation of the Hardinge mill, and possibly even after the addition of an adequate air blast in May, the defendant's operations were tentative and experimental. For example Smith testified that between March 21 and September 21 the engineer "had acquired the necessary skill to operate his mill" so far as the matter of temperature was concerned, and that "by the middle of 1921 he had got most of his mechanical difficulties straightened out and from that time was able to produce material satisfactorily". The witness Hall testified that for some four or five months after he started the mill (which would cover the time,

say, up to the middle of June) he was experimenting with a low oxide product which was never used commercially.

It is therefore plain that there is no evidence of anything beyond an experimental use by the defendant earlier than about the middle of the year 1921. It is entirely possible that the word "January" in the second statement of fact referred to above is a mere typographical error and that what the Court had in mind was, "June". However that may be and in order to avoid any possible misunderstanding as to the scope of the finding, I will amend it to read "Commercial production by the Hardinge mill with its forced air draft undoubtedly involved the use of the plaintiff's patent, and June, 1921, may be fixed as the date when that began".

The whole question has been thoroughly argued by counsel on both sides and it will not be necessary to take further testimony or to hear further argument. The rehearing is granted. Argument upon the presentation of the petition may be taken as having been made upon rehearing and the opinion will be amended in the two particulars referred to in the foregoing memorandum.

DECREE.

(Filed Dec. 14, 1936.)

This cause coming on to be heard at this Term of the Court, and upon the pleadings and proofs and argument presented by both parties, and the Court having filed its written opinion containing special findings of fact and conclusions of law, and upon consideration thereof, it is

Ordered, Adjudged and Decreed as follows:

1. That claims 1 and 2 of letters patent of the United States No. 1,584,149, granted to Genzo Shimadzu, dated May 11, 1926, being one of the letters patent in suit, are good and valid in law.

2. That claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, and 17 of letters patent of the United States No. 1,584,150, granted to Genzo Shimadzu, dated May 11, 1926, being one of the letters patent in suit, are good and valid in law.

3. That claims 1, 2, 3, 4, and 5 of letters patent of the United States No. 1,584,151, granted to Genzo Shimadzu, dated May 11, 1926, being one of the letters patent in suit; are good and valid in law.

4. That claims 1 and 2 of letters patent of the United States No. 1,584,152, granted to Genzo Shimadzu, dated May 11, 1926, being one of the letters patent in suit, are good and valid in law.

5. That claims 1, 2, 3, and 4 of letters patent of the United States No. 1,584,479, granted to Genzo Shimadzu, dated May 11, 1926, being one of the letters patent in suit, are good and valid in law.

6. That claims 10 and 11 of letters patent of the United States No. 1,896,020, granted to Genzo Shimadzu, dated January 31, 1933, being one of the letters patent in suit, are good and valid in law.

7. That the plaintiff, Genzo Shimadzu, now has and has had continuously since the issuance thereof title to each of the aforesaid letters patent of the United States, and Northeastern Engineering Corpo-

lation is and has been since the 14th day of February 1933, the exclusive licensee thereunder for the United States.

8. That the defendant, The Electric Storage Battery Company, has within six years prior to the filing of the Bill of Complaint herein infringed upon claims 1 and 2 of said United States letters patent No. 1,584,149, claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12, and 13 of said United States letters patent No. 1,584,150 and claims 10 and 11 of said United States letters patent No. 1,896,020, and has violated the exclusive rights of the plaintiffs thereunder by using and/or practicing the processes described and claimed in said claims of said letters patent 1,584,149 and 1,584,150 and by making and using the apparatus described and claimed in said claims 10 and 11 of letters patent No. 1,896,020.

9. That claims 14, 15, 16, and 17 of United States letters patent No. 1,584,150; claims 1, 2, 3, 4, and 5 of letters patent No. 1,584,151; claims 1 and 2 of letters patent No. 1,584,152; and claims 1, 2, 3, and 4 of letters patent No. 1,584,479 have not been proven to have been infringed by the defendant.

10. That a writ of injunction for the full term of the respective patents listed in this Paragraph issue forthwith out of and under the seal of this court directed to the defendant, The Electric Storage Battery Company, enjoining and restraining the said defendant, and its officers, directors, associates, attorneys, clerks, servants, agents, workmen, employees and confederates, and each of them, from directly or indirectly using and/or practicing and/or threatening to use and/or practice the processes and methods described in said letters patent Nos. 1,584,149 and 1,584,-

150, and claimed in claims 1 and 2 of letters patent No. 1,584,149 and 1, 2, 3, 4, 6, 8, 9, 10, 11, 12, and 13 of letters patent No. 1,584,150, and from directly or indirectly making, using and/or selling and/or causing to be manufactured, used and/or sold and/or threatening to manufacture, use and/or sell, apparatus containing or embodying the inventions of claims 10 and 11 of United States letters patent No. 1,896,020, and from in any wise infringing said letters patent and each of them and/or contributing to the infringement of said letters patent and each of them by others, and/or conspiring to so infringe said letters patent and each of them in any way whatsoever, and from directly or indirectly secreting, depleting, dissipating or in any manner disposing of the profits, gains and/or advantages which the defendant and its subsidiaries have derived from their infringement.

11. That the plaintiffs recover from the defendant and its said subsidiaries, the profits, gains and/or advantages which the said defendant and its said subsidiaries have received or which may have accrued to them by reason of their said infringement of said claims of said letters patent in suit, as well as the damages suffered by plaintiffs by reason of said infringement.

12. That this cause be referred to as Special Master of this Court, who is hereby appointed to ascertain, take, state and report to the Court the profits, gains and/or advantages made by the defendant, resulting from the use, practice and employment of the inventions of said claims of said United States Letters Patent Nos. 1,584,149, 1,584,150, and 1,896,020, and also the amount of lead oxide and lead powder made by said defendant by its mills, so held to infringe hereunder, by reason of its infringement of said letters patent throughout the period be-

ginning six years before the date of the filing of the Bill of Complaint herein, and the damages which the plaintiffs have suffered by reason of said infringement, and the plaintiffs on said accounting shall have the right to cause the examination of the officers, servants, agents and employees of the defendant, orally or otherwise, and also to examine other witnesses, and to cause the production and examination of the books, vouchers, records and documents of said defendant, and to have all necessary process of the court to compel such attendance and production before the said master.

13. That the plaintiffs recover from the said defendant the taxable costs and disbursements of the plaintiffs in this court, and that the plaintiffs shall have judgment and execution against the said defendant for said profits, damages and costs.

W. H. KIRKPATRICK,
J.

PETITION FOR APPEAL.
(Filed Dec. 14, 1936.)

To the Honorable William H. Kirkpatrick, Judge of the District Court of the United States for the Eastern District of Pennsylvania:

The Electric Storage Battery Company, your petitioner, who is the defendant in the above-entitled cause, prays that it may be permitted to take an appeal from the decree entered in the above cause on the 14th day of December, 1936, to the United States Circuit Court of Appeals for the Third Circuit, for the reasons specified in the assignment of errors which is filed herewith.

And your petitioner desires that said appeal shall operate as a supersedeas, and therefore prays that an order be made fixing the amount of security which said The Electric Storage Battery Company shall give and furnish upon such appeal, and that, upon its giving bond in an amount to be fixed by this court, the said appeal may operate as a supersedeas and may suspend, during pendency of said appeal, the effect of any injunction.

14 December 1936.
Philadelphia, Pennsylvania.

AUGUSTUS B. STOUGHTON,
E. S. W. FARNUM, JR.,
Attorneys for Defendants.

ORDER ALLOWING APPEAL.

(Filed Dec. 14, 1936.)

The petition of The Electric Storage Battery Company, defendant in the above-entitled cause, for an appeal from the final decree, is hereby granted and the appeal is allowed; and upon petitioner filing a bond in the sum of Fifty Thousand Dollars ($50,000.00) with sufficient sureties and conditioned as required by law, the same shall operate as a supersedeas of the decree made and entered in the above cause, and shall suspend and stay all further proceedings in this court including any injunction and until the termination of said appeal by the United States Circuit Court of Appeals for the Third Circuit.

14 December 1936.
Philadelphia, Pennsylvania.

W. H. KIRKPATRICK,
District Judge.

ASSIGNMENTS OF ERROR.

(Filed Dec. 14, 1936.)

And Now, comes The Electric Storage Battery Company, defendant-below appellant, by Augustus B. Stoughton and E. S. W. Farnum, Jr., Esquires, its solicitors, and says that in the record of proceedings and in the decree in the above-stated cause, there is manifest error in the following, to wit:

(1) In holding and adjudging that Claims 1 and 2 of Patent No. 1,584,149 are severally valid.

(2) In not holding and adjudging Claims 1 and 2 of Patent No. 1,584,149 severally invalid under Revised Statute 4887.

(3) In not holding and adjudging Claim 1 of Patent No. 1,584,149 invalid under R. S. 4887 by reason of Japanese Patent No. 41,728.

(4) In not holding and adjudging Claim 2 of Patent No. 1,584,149 invalid under R. S. 4887 by reason of Japanese Patent No. 42,563.

(5) In not holding and adjudging Claims 1 and 2 of Patent No. 1,584,149 severally invalid by reason of the prior knowledge and of the prior use of the subject matter thereof by The Electric Storage Battery Company for more than two years prior to the application date for said patent.

(6) In not holding and adjudging Claims 1 and 2 of Patent No. 1,584,149 anticipated and severally invalid by reason of Belgium Patent No. 284,885 of February 4, 1920.

(7) In not holding and adjudging Claims 1 and 2 of Patent No. 1,584,149 severally invalid for want of invention in view of the state of the prior art.

(8) In holding and adjudging that the date of the alleged invention of Patent No. 1,584,149 was not later than August 1919.

(9) In holding and adjudging that the Claims of Japanese Patents No. 41,728 and No. 42,563 are not for the same alleged invention as claimed in Claims 1 and 2 respectively of Patent No. 1,584,149.

(10) In holding and adjudging that Claims 1 and 2 of Patent No. 1,584,149 have been infringed by The Electric Storage Battery Company.

(11) In holding and adjudging that Claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of Patent No. 1,584,150 are severally valid.

(12) In not holding and adjudging that Claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of Patent No. 1,584,150 are severally invalid under Revised Statute 4887.

(13) In not holding and adjudging that Claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of Patent No. 1,584,150 are severally invalid under R. S. 4887 by reason of Japanese Patent No. 42,563.

(14) In not holding that Claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of Patent No. 1,584,150 are severally invalid under R. S. 4886 in that the subject matter of Shimadzu's alleged invention was known by The Electric Storage Battery Company and others in this

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country before Shimadzu's alleged invention or discovery thereof.

(15) In not holding and adjudging that claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of Patent No. 1,584,150, are severally invalid under R. S. 4887 by reason of public use in this country by The Electric Storage Battery Company for more than two years prior to the filing date of said patent in this country.

(16) In not holding and adjudging that Claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of Patent No. 1,584,150 are severally invalid by reason of United States Patent No. 1,584,149.

(17) In not holding and adjudging that Claims 1 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of Patent No. 1,584,150 are severally invalid by reason of R. S. 4888.

(18) In not holding and adjudging that Claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of Patent No. 1,584,150 are severally invalid under R. S. 4888 in that Patent No. 1,584,150 does not teach one skilled in the art how to prodr lead oxide.

(19) In not holding and adjudging that Claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of Patent No. 1,584,150 are severally invalid for want of novelty and invention in view of the state of the prior art.

(20) In holding and adjudging that the date of the alleged invention of Patent No. 1,584,150 was not later than August, 1919.

(21) In holding and adjudging that claims of Japanese Patent No. 42,563 are not for the same

alleged invention as the process claims of Patent No. 1,584,150.

(22) In not holding and adjudging that Claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of Patent No. 1,584,150 have not been severally infringed by The Electric Storage Battery Company.

(23) In holding and adjudging that Claims 10 and 11 of Patent No. 1,896,020 are severally valid.

(24) In not holding and adjudging that Claims 10 and 11 of Patent No. 1,896,020 are severally invalid.

(25) In not holding and adjudging that Claims 10 and 11 of Patent No. 1,896,020 are severally invalid in that said two claims were inserted in the application for said patent by amendment on June 4, 1932 after plaintiff had full knowledge of defendant's apparatus.

(26) In not holding and adjudging that Claims 10 and 11 of Patent No. 1,896,020 are severally invalid in that said claims were inserted by amendment in the renewed application for said patent on June 4, 1932, nearly four years after Hall Patent No. 1,675,345 had issued.

(27) In not holding and adjudging that Claims 10 and 11 of Patent No. 1,896,020 are severally invalid in that said claims were inserted in the renewed application on June 4, 1932, two years after one or more employees of The Electric Storage Battery Company, having knowledge of the latter's apparatus, had left the employ of The Electric Storage Battery Company without any pledge of secrecy.

(28) In not holding and adjudging Claims 10 and 11 of Patent No. 1,896,020 are severally invalid by reason of Japanese Patents No. 41,728 and No. 42,563.

(29) In not holding and adjudging that Claims 10 and 11 of Patent No. 1,896,020 are severally invalid in view of the two years' prior knowledge and use of the subject matter of these claims by The Electric Storage Battery Company.

(30) In not holding and adjudging that Claims 10 and 11 of Patent No. 1,896,020 are invalid because of the patentee's attempt to cover thereby the apparatus used by The Electric Storage Battery Company, of which the patentee had knowledge, for many years prior to the insertion of said claims in the application for said patent.

(31) In holding and adjudging that The Electric Storage Battery Company has infringed Claims 10 and 11 of Patent No. 1,896,020.

(32) In holding there was no suggestion or thought on the part of The Electric Storage Battery Company of blowing or forcing the air into the drum of its Tudor Mill.

(33) In holding and adjudging, as a matter of law, that plaintiff is entitled to rely for priority upon the date of invention of Patents No. 1,584,149 and No. 1,584,150 and No. 1,896,020, regardless of the fact that the invention was made in a foreign country.

(34) In holding and adjudging that the amount of product obtained by The Electric Storage Battery Company in its Tudor Mill was very limited.

(35) In holding and adjudging that The Electric Storage Battery Company had no thought of temperature control to get the maximum degree of oxidation in the drum of the Tudor Mill.

(36) In not holding and adjudging that plaintiff is estopped by reason of the position taken by patentee in the Hall-Shimadzu Interference from asserting or claiming that the process employed by The Electric Storage Battery Company is the process covered by the process claims, or any of them of Patent No. 1,584,150.

(37) In holding and adjudging that a first inventor in taking out a patent has, as a matter of law, the right if he choose, to withhold the really essential steps of the invention.

(38) In holding and adjudging that, as a matter of law, an invention similar to or identical with an invention of a first inventor and made or brought into use by a second inventor during concealment of the invention by the first inventor can, upon proof of the identity of the second invention with the really essential steps previously invented and withheld by the first inventor, be inhibited or restricted.

(39) In not holding and adjudging that, as a matter of law, a first inventor, Shimadzu, who suppresses and conceals his invention when he filed application for Japanese Patent 42,563 on November 27th, 1920, until he filed on February 3rd, 1923 Japanese Patent 60,825 corresponding to U. S. 1,584,150, loses his patent rights as against a second independent inventor Hall who reduced the invention to prac-

tice June, 1921, during suppression or concealment by the first inventor.

(40) In holding and adjudging, as a matter of law, that the construction of Japanese Patent No. 42,563 should, for the purposes of Section 4887 R. S., be construed literally in respect to Claim 1 and should be construed broadly to include the meaning and purposes given to the patent as a whole by the patentee for purposes of differentiation from Japanese Patent No. 60,825.

(41) In not holding and adjudging, as a matter of law, that the claims of patents are to be construed in the light of their specifications as understood by those skilled in the art.

(42) In holding and adjudging that Shimadzu was entitled to carry his date of invention back more than two years prior to the filing date in respect to patents or printed publications preceding his U. S. filing date and constituting a statutory bar, under R. S. Section 4887.

(43) In not holding and adjudging that Claims 1 to 9, inclusive, and 11 to 13, inclusive, of Patent No. 1,584,150, are severally invalid under R. S. 4886 and 4887, by prior patenting and printed publication for more than two years prior to July 14, 1923, its filing in the United States, in the Belgian Tudor patent 239,406 of May 4, 1920, the Thibault French patent No. 494,270, of September 4, 1919, and others in the prior art.

(44) In not dismissing the bill of complaint for want of equity.

(45) In ordering and adjudging that writ of injunction issue out of and under the seal of this Court directed to the defendant, The Electric Storage Battery Company, enjoining and restraining the said defendant from using or practicing the processes and methods described in Letters Patent No. 1,584,149 and No. 1,594,150 and claimed in Claims 1 and 2 of Letters Patent No. 1,584,149 and Claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of Letters Patent No. 1,584,150 and from making, using or selling apparatus containing or embodying the inventions of Claims 10 and 11 of Patent No. 1,896,020.

(46) In ordering and adjudging that The Electric Storage Battery Company account to plaintiffs.

E. S. W. FARNUM,
Solicitor.

AUGUSTUS B. STOUGHTON.
12/14/36.

CITATION.
(Filed Dec. 19, 1936.)

UNITED STATES OF AMERICA, SS:

The President of the United States:

To GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION

GREETING:

You are hereby cited and admonished to be and appear at a United States Circuit Court of Appeals for the Third Circuit, to be holden at the City of Philadelphia within thirty days, pursuant to an ap-

peal filed in the Clerk's Office of the District Court of the United States, Eastern District of Pennsylvania, wherein THE ELECTRIC STORAGE BATTERY COMPANY is appellant, and you are appellees to show cause, if any there be, why the Decree rendered against the said appellant as in the said appeal mentioned, should not be corrected, and why speedy justice should not be done to the parties in that behalf.

WITNESS, the Honorable W. H. KIRKPATRICK Judge of the District Court of the United States, this 14th day of December, in the year of our Lord one thousand nine hundred and thirty-six.

W. H. KIRKPATRICK,
District Judge.

December 16, 1936.
Service accepted.

JOSEPH W. HENDERSON,
Attorney for Appellee.

PETITION FOR CROSS-APPEAL BY PLAINTIFFS.

(Filed Jan. 12, 1937.)

To the Honorable the Judges of the United States District Court for the Eastern District of Pennsylvania:

The above named plaintiffs, Genzo Shimadzu and Northeastern Engineering Corporation, conceiving themselves aggrieved by the interlocutory decree made and entered herein on the 14th day of December, A. D., 1936, does hereby appeal from said decree

to the United States Circuit Court of Appeals for the Third Circuit, for the reasons specified in the assignments of error filed herewith, and prays that this appeal be allowed, and that citation be issued as provided by law, directed to the above named defendant, The Electric Storage Battery Company, commanding it to appear before the United States Circuit Court of Appeals for the Third Circuit, to do and receive what may pertain to justice to be done in the premises, and that a transcript of the record, proceedings and documents upon which said decree was made, duly authenticated, be sent to the United States Circuit Court of Appeals for the Third Circuit.

RAWLE & HENDERSON,
HUNT, HILL & BETTS,
EDMUND B. WHITCOMB,
Solicitors for Plaintiffs.

Dated, January 12, 1937.

ORDER ALLOWING APPEAL.

(Filed Jan. 12, 1937.)

And Now, to-wit, this 12th day of January, A. D., 1937, upon consideration of the attached petition for cross-appeal of the plaintiffs, cross-appellants, and the assignments of error filed herein, and the bond for costs in the sum of $250.00, with the Aetna Casualty & Surety Company as surety, submitted herewith, it is hereby

ORDERED, that said bond is approved as to amount and surety, and that the cross-appeal prayed for in said petition be and hereby is allowed.

W. H. KIRKPATRICK,
J.

PLAINTIFFS' ASSIGNMENTS OF ERROR ON CROSS APPEAL.

(Filed Jan. 12, 1937.)

And Now come Genzo Shimadzu and Northeastern Engineering Corporation, plaintiffs below, appellants, by Hunt, Hill & Betts, Edmund B. Whitcomb and Rawle & Henderson, their solicitors, and say that in the record of proceedings and in the decree in the above stated cause, there is manifest error in the following, to wit:

1. In holding and adjudging that claims 14, 15, 16 and 17 of United States Letters Patent No. 1,584,150 have not been proven to have been infringed by defendant.

2. In holding and adjudging that claims 1, 2, 3, 4 and 5 of United States Letters Patent No. 1,584,151 have not been proven to have been infringed by defendant.

3. In holding and adjudging that claims 1, 2, 3 and 4 of United States Letters Patent No. 1,584,479 have not been proven to have been infringed by defendant.

4. In not holding and adjudging that the product manufactured by defendant within six years prior to the filing of the bill of complaint herein contained a comminuted lead lead suboxide mixture with apparent specific gravity 1. to 3, as specified in claim 14 of the Shimadzu patent 1,584,150.

5. In not holding and adjudging that the product manufactured by defendant within six years prior to

the filing of the bill of complaint herein comprised a highly chemically reactive finely divided powder comprising a major portion of lead suboxide, said powder being capable of spontaneous oxidation, as specified in claim 15 of Shimadzu patent 1,584,150.

6. In not holding and adjudging that the product made within the rotating mills, employed by defendant within six years prior to the filing of the bill of complaint herein comprised a highly chemically reactive finely divided powder comprising a major portion of the lead suboxide, said powder being capable of spontaneous oxidation, as specified in claim 15 of Shimadzu patent 1,584,150.

7. In not holding and adjudging that the product manufactured by defendant within six years prior to the filing of the bill of complaint herein comprised a highly chemically reactive powder, comprising a large portion of lead suboxide, said powder being capable of spontaneous reaction on contact with moisture, as specified in claim 16 of Shimadzu patent 1,584,150.

8. In not holding and adjudging that the product made within the rotating mills employed by defendant within six years prior to the filing of the bill of complaint herein comprised a highly chemically reactive powder, comprising a large portion of lead suboxide, said powder being capable of spontaneous reaction on contact with moisture, as specified in claim 16 of Shimadzu patent 1,584,150.

9. In not holding and adjudging that the product manufactured by defendant within six years prior to the filing of the bill of complaint herein comprised a highly chemically reactive powder, comprising a large

portion of lead suboxide, said powder being capable of spontaneous reaction on contact with air as specified in claim 17 of the Shimadzu patent 1,584,150.

10. In not holding and adjudging that the product made within the rotating mills employed by defendant within six years prior to the filing of the bill of complaint herein comprised a highly chemically reactive powder, comprising a large portion of lead suboxide, said powder being capable of spontaneous reaction on contact with air as specified in claim 17 of Shimadzu patent 1,584,150.

11. In holding and adjudging that the process employed by defendant within six years prior to the filing of the bill of complaint herein did not involve the method of forming finely divided lead oxide in the manner as stated in each of claims 1, 2, 3 and 4 of Shimadzu patent 1,584,151.

12. In not holding and adjudging that the process as practiced by defendant within six years prior to the filing of the bill of complaint herein, within the rotating mills employed by defendant, included, as stated in the claims of Shimadzu patent 1,584,151 the formation of finely divided oxygenated lead compounds by treating a finely divided chemically reactive powder comprising a major portion of lead suboxide with an oxidizing substance.

13. In not holding and adjudging that the process as practiced by defendant within the rotating mills employed by defendant within six years prior to the filing of the bill of complaint herein, included, as stated in the claims of Shimadzu patent 1,584,151, the formation of finely divided oxygenated lead com-

pounds by treating a finely divided chemically reactive powder comprising a major portion of lead suboxide with an oxidizing substance, and maintaining the reaction by the evolved heat of reaction.

14. In not holding and adjudging that the process employed by defendant within six years prior to the filing of the bill of complaint herein, in manufacturing plates for storage batteries, involved kneading lead suboxide intermingled with lead monoxide, with or without metallic lead, and sufficient liquid to form a paste and applying the same to or filling therewith the plates or grids, in the manner specified in the claims of the Shimadzu patent No. 1,584,479.

15. In not extending the injunction in paragraph 10 of the decree herein to claims 14, 15, 16 and 17 of Shimadzu patent 1,584,150; claims 1, 2, 3, 4 and 5 of Shimadzu patent 1,584,151 and claims 1, 2, 3 and 4 of Shimadzu patent 1,584,479.

16. In not extending the recovery directed in paragraph 11 of the decree herein to include the defendant's profits, gains and/or advantages and also the damages suffered by plaintiffs by reason of defendant's infringement of claims 14, 15, 16 and 17 of Shimadzu patent 1,584,150; claims 1, 2, 3, 4 and 5 of Shimadzu patent 1,584,151 and claims 1, 2, 3 and 4 of Shimadzu patent 1,584,479.

17. In not extending the accounting directed in paragraph 12 of the decree herein to the profits, gains and/or advantages made by the defendant and the damages suffered by plaintiffs by reason of the defendant's infringement of claim 14, 15, 16 and 17 of Shimadzu patent 1,584,150; claims 1, 2, 3, 4 and 5 of

Shimadzu patent 1,584,151 and claims 1, 2, 3, and 4 of Shimadzu patent 1,584,479.

18. In finding and adjudging that commercial production by the Hardinge mill with its forced draft involving the use of plaintiff's patent began in June 1921.

RAWLE & HENDERSON,
HUNT, HILL & BETTS,
EDMUND B. WHITCOMB,
Solicitors for Plaintiffs.

CITATION.

(Filed Jan. 13, 1937.)

UNITED STATES OF AMERICA, *ss.*:

THE PRESIDENT OF THE UNITED STATES,

To The Electric Storage Battery Company

GREETING:

You are hereby cited and admonished to be and appear at a United States Circuit Court of Appeals for the Third Circuit, to be holden at the City of Philadelphia within thirty days, pursuant to an appeal filed in the Clerk's Office of the District Court of the United States, Eastern District of Pennsylvania, wherein Genzo Shimadzu and Northeastern Engineering Corporation are appellants and you are appellee to show cause, if any there be, why the decree rendered against the Electric Storage Battery Company as in the said appeal mentioned, should not be corrected, and why speedy justice should not be done to the parties in that behalf.

WITNESS, the Honorable Wm. H. Kirkpatrick, Judge of the District Court of the United States; this 12th day of January, in the year of our Lord one thousand nine hundred and thirty-seven.

W. H. KIRKPATRICK,
District Judge.

January 1937.
Service accepted.

AUGUSTUS B. STOUGHTON
E. S. W. FARNUM, JR.
Attorneys for Electric Storage Battery Company.

PRAECIPE FOR TRANSCRIPT OF RECORD.
(Filed July 3, 1937.).

To the Clerk of the District Court of the United States for the Eastern District of Pennsylvania:

You are hereby requested to prepare and certify the transcript of record to be filed in the United States Circuit Court of Appeals for the Third Circuit pursuant to an appeal allowed in the above-entitled causes and to include in said transcript the following:

1. Docket entries.

2. Bill of Complaint.

3. Answer.

4. Motion by Plaintiffs for Leave to Inspect Defendant's Plant, filed December 19, 1933.

5. Affidavit of L. S. Ishimura, filed Dec. 19, 1933.

6. Defendant's Answer to Motion and Affi-

davits of J. R. Williams, E. W. Smith, Clarence A. Hall, J. L. Woodbridge, and C. Reed Cary, filed December 19, 1933.

7. Affidavit of E. W. Smith, filed Dec. 20, 1933.

8. Defendant's Motion for Bill of Particulars, filed June 8, 1935.

9. Interrogatories Propounded by Defendant to Plaintiffs, filed June 8, 1935.

10. Interrogatories Propounded by Plaintiffs to Defendant, pursuant to Equity Rule 58.

11. Plaintiff's Motion for Further and Better Particulars of Defenses.

12. Defendant's Bill of Particulars, filed Aug. 29, 1935.

13. Answer by R. C. Norberg to Plaintiff's Interrogatories, filed Aug. 29, 1935.

14. Answer to Interrogatories Propounded by Defendant to Plaintiffs, filed Sept. 19, 1935.

15. Plaintiffs' Bill of Particulars, filed September 19, 1935.

16. Order for Issuance of Letters Rogatory to Kyoto, Japan.

17. Opinion of Kirkpatrick, J., filed Oct. 6, 1936.

18. Memorandum amending opinion, filed Nov. 20, 1936.

19. Final Decree, filed Dec. 14, 1936.

20. Petition for an Appeal, filed Dec. 14, 1936.

21. Order Allowing an Appeal, filed Dec. 14, 1936.

22. Assignments of Error, filed Dec. 14, 1936.

23. Citation on Appeal, returned Dec. 19, 1936.

24. Petition for Cross-Appeal by Plaintiffs, filed Jan. 12, 1937.

25. Order allowing Appeal, filed Jan. 12, 1937.

26. Plaintiffs' Assignments of Error, filed Jan. 12, 1937.

27. Citation on Appeal, filed Jan. 12, 1937.

28. Plaintiffs' Physical Exhibits according to attached list (to be certified but not reproduced).

29. Defendant's Phsyical Exhibits according to attached list (to be certified but not reproduced).

30. Stipulation concerning statement of testimony and evidence, filed April 19, 1937, and statement of the evidence as specified in and attached to said Stipulation.

31. Order approving foregoing Stipulation, filed April 19, 1937.

32. This Praecipe.

33. Certificate of Transcript.

HUGH M. MORRIS,
AUGUSTUS B. STOUGHTON,
E. S. W. FARNUM, JR.,
Solicitors for Defendant-Appellant and Appellee in Cross-Appeal.

May 24, 1937
Philadelphia, Pennsylvania.

We hereby acknowledge service of copy of the foregoing praecipe this 24th day of May, 1937, and agree that the same embraces all of the papers and documents which plaintiffs-cross appellants desire incorporated in the transcript on appeal.

RAWLE & HENDERSON,
HUNT, HILL & BETTS,
Solicitors for Plaintiffs-Appellees and Appellants in Cross Appeal.

PHYSICAL EXHIBITS
(no duplicates)

PLAINTIFFS'.

7 —Ishimura's Japanese Note-book, Sept. 1918 to July, 1919
8 — " " " " July, 1919 to March, 1921
22 —Sample of material
(a) —Sealed Tube of Powder from Defendant's Mill
(b) — " " " " " " "
(c) — " " " " " " "
(d) — " " " " " " "
(e) — " " " " " " "
(f) —Lead Ball from Defendant's Mill
(g) —Lead Ball

23-A-1—Film relating to Plaintiffs' Exhibit 22-A
23-A-2— " " " " " "
23-A-3— " " " " " "
23-D-1— " " " " " 22-D

23-D-2— " " " " " "
23-D-3— " " " " " "
23-E-1— " " " " " 22-E
23-E-2— " " " " " "
23-E-3— " " " " " "
23-G-1 —" " " " " 22-G
23-G-2— " " " " " "
23-G-3— " " " " " "
23-G-4— " " " " " "
23-H-1— " " " " " 22-H
23-H-2— " " " " " "
23-H-3— " " " " " "

23-I-1 —X-Ray Films of Powder from Mill No. 3, Run 31, Aug. 3, 1934

23-I-2 —X-Ray Films of Powder from Mill No. 3, Run 31, Aug. 3, 1934

28(a) —Film of sample of Exide Oxide number 94B
(b) — " " " " Prest-O-Lite Oxide
(c) — " " " " " " " "

32 —Negative Group of Plates (Kyle)

33 —Positive " " " "

34 —Wooden Separators "

35 —Battery Unit "

54 —Film entitled "Special Nickel Filtered Radiation"

55 —Glass Tube containing fractionated sample

60 —Film of Aged and exposed Exide sample

PHYSICAL EXHIBITS
(no duplicates)

DEFENDANT'S.

75 —Sealed Tube containing sample of powder taken from Toronto Mill

138 —Dr. Davey's Note-book No. 1

139 — " " " " " 4

140 — " " " " " 2

141 — " " " " " 3

142 —Work sheet showing Lead Oxalate decomposition product after two hours at 310 deg.

(a)—Film for Exhibit 142

143 —Work Sheet "Transcription of Oxalate Films"

(a) Film of Exhibit 143

144 —X-Ray Analysis of Gray Oxide (Finished Product)

(a) Film of Exhibit 144

145 —X-Ray Analysis of Gray Oxide (Finished (Product)

(a) —Film of Exhibit 145

146 —X-Ray Analysis of Gray Oxide (Under (Screen) first official sample

(a) —Film of Exhibit 146

147 —X-Ray Analysis of Pb and PbO (Mechanical mixture of 67.51% 32.49%)

(a)—Film of Exhibit 147

148 —Lead Ball taken from inside of Mill near discharge end. X-Ray Analysis of Powder from Surface of Lead Ball.

(a)—Film of Exhibit 148.

149 —X-Ray Analysis of Gray Oxide (Under Screen) second official sample

(a)—Film of Exhibit 149

150 —X-Ray Analysis of Gray Oxide (Screen Product over P_2O_5)

(a)—Film of Exhibit 150

151 —X-Ray Analysis of Gray Oxide (Finished Product P_2O_5)

(a)—Film Exhibit 151

157 —Dr. Davey's films of E.S.B.Co.'s Gray Oxide

158 — " " " " " " " "

159 —Box of films

160 — " " "

178 —X-Ray Analysis of decomposition product of Lead Oxalate and "Interplaner Spacings of Decomposition product of Lead Oxalate."

(a)—Film of Exhibit 178

180 —Box containing card (colored)

183 —Half of Lead Ball (Dr. Ullmann)

UNITED STATES OF AMERICA
EASTERN DISTRICT OF PENNSYLVANIA } ss:

I, George Brodbeck, Clerk of the United States District Court in and for the Eastern District of Pennsylvania, do hereby certify that the annexed and foregoing is a true and full copy of so much of the pleas and proceedings; in the case of Genzo Shimadzu and Northeastern Engineering Corporation vs. The Elec-

tric Storage Battery Co., No. 7727 March Term, 1933, as per praecipe filed, (with exception of exhibits), a copy of which is hereto attached, the transcript of record in the above entitled cause is to include — — — now remaining among the records of the said Court in my office.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the seal of the aforesaid Court at Philadelphia this day of October, A. D. 1937.

(Seal)

GEORGE BRODBECK,
Clerk.

ORDER ASSIGNING HON. OLIVER B. DICKINSON FOR ARGUMENT.

(Filed May 12, 1938.)

IN THE UNITED STATES CIRCUIT COURT OF APPEALS,
FOR THE THIRD CIRCUIT.

No. 6309. March Term, 1938.

Electric Storage Battery Company,
Appellant,

v.

Genzo Shimadzu and Northeastern Engineering Corp.,
Appellee.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOT THE EASTERN DISTRICT OF PENNSYLVANIA.

And now, to wit: this twelfth day of May, A. D. 1938, it is ordered that Hon. Oliver B. Dickinson, District Judge for the Eastern District of Pennsylvania, be and he is hereby assigned to sit in above case in order to make a full court.

JOSEPH BUFFINGTON,
Circuit Judge.

(Endorsements.)—Order Assigning Hon. Oliver B. Dickinson for Argument Received and Filed May 12, 1938. Wm. P. Rowland, Clerk.

REFERENCE TO ARGUMENT.

IN THE UNITED STATES CIRCUIT COURT OF APPEALS,
FOR THE THIRD CIRCUIT.

No. 6309. October Term, 1937.

Electric Storage Battery Co.,
Defendant-Appellant,

v.

Genzo Shimadzu and Northeastern Engineering Corp.,
Plaintiffs-Appellees.

And afterwards, to wit, the twelfth day of May, 1938, come the parties aforesaid by their counsel aforesaid, and this case being called for argument sur pleadings and briefs, before the Honorable Joseph Buffington and Honorable J. Warren Davis, Circuit Judges, and Honorable Oliver B. Dickinson, Judge, and the Court not being fully advised in the premises, takes further time for the consideration thereof,

And afterwards, to wit, on the eighth day of August, 1938, come the parties aforesaid by their counsel aforesaid, and the court, now being fully advised in the premises, renders the following decision:

IN THE

UNITED STATES CIRCUIT COURT OF APPEALS,

FOR THE THIRD CIRCUIT.

No. 6309. October Term, 1937.

THE ELECTRIC STORAGE BATTERY CO.,
Defendant-Appellant,

v.

GENZO SHIMADZU AND NORTHEASTERN ENGINEERING CORPORATION,
Plaintiffs-Appellees.

No. 6336. October Term, 1937.

GENZO SHIMADZU AND NORTHEASTERN ENGINEERING CORPORATION,
Plaintiffs-Cross-Appellants,

v.

THE ELECTRIC STORAGE BATTERY CO.,
Defendant-Cross-Appellee.

APPEALS FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE EASTERN DISTRICT OF PENNSYLVANIA.

OPINION.

(Filed August 8, 1938.)

Before BUFFINGTON and DAVIS, *Circuit Judges,* and DICKINSON, *District Judge.*

PER CURIAM:

Genzo Shimadzu as owner and patentee and the Northeastern Engineering Company as exclusive

licensee, of six patents, brought suit in the District Court against the Electric Storage Battery Company, defendant, for infringement of these patents. That Court entered a decree finding the following claims valid and infringed: claims 1 and 2 of patent No. 1,584,149; claims 1, 2, 3, 4, 6, 8, 9, 10, 11, 12 and 13 of patent No. 1,584,150; and claims 10 and 11 of patent No. 1,896,020. It also held the following claims valid but not infringed: claims 14, 15, 16 and 17 of patent No. 1,584,150; claims 1, 2, 3, 4, and 5 of patent No. 1,584,151; claims 1 and 2 of patent No. 1,584,152; and claims 1, 2, 3, and 4 of patent No. 1,584,479. Upon these findings, the District Court issued an appropriate injunction and ordered an accounting of profits and damages. Both the plaintiffs and the defendant have appealed to this court.

These patents contain process and apparatus claims relating to the manufacture of a fine powder of lead or lead oxide; claims relating to the manufacture of lead suboxide powder; product claims for lead suboxide; claims relating to the use of lead suboxide powder in a process for further oxidation into such products as litharge and red lead; and claims relating to the use of lead suboxide powder in the manufacture of plates for storage batteries and paints.

The claims held valid and infringed were the process and apparatus claims relating to the manufacture of the fine powder of lead or lead oxide. The other claims all refer to lead suboxide and these were all held vaid but not infringed because of the doubt surrounding the existence of that product.

Several questions are here at issue. These involve the validity of the patents under section 4887 of the Revised Statutes, (35 U. S. C. A. 32); the validity of the patents in view of the prior art, and the existence of the product lead suboxide.

After a careful examination of the record and briefs, we are of the opinion that the facts found by the learned District Judge are based upon substantial evidence, that he has properly applied the law to these facts and reached correct conclusions.

Accordingly we affirm the decree upon his opinion.

A true Copy:

Teste:

Clerk of the United States Circuit Court of Appeals for the Third Circuit.

ORDER AFFIRMING DECREE.

(Filed August 8, 1938.)

IN THE UNITED STATES CIRCUIT COURT OF APPEALS,
FOR THE THIRD CIRCUIT.

No. 6309. October Term, 1937.

Electric Storage Battery Co.,
Defendant-Appellant,

v.

Genzo Shimadzu and Northeastern Engineering Corp.,
Plaintiffs-Appellees.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES, FOR THE EASTERN DISTRICT OF PENNSYLVANIA.

This cause came on to be heard on the transcript of record from the District Court of the United States, for the Eastern District of Pennsylvania, and was argued by counsel.

On consideration whereof, it is now here ordered, adjudged, and decreed by this Court that the decree of the said District Court in this cause be, and the same is hereby affirmed, with costs.

Philadelphia,

J. WARREN DAVIS,
Circuit Judge.

August 8, 1938.

(Endorsements.)—Order Affirming Decree Received and Filed August 8, 1938. Wm. P. Rowland, Clerk.

1227

IN THE

United States Circuit Court of Appeals

FOR THE THIRD CIRCUIT.

No. 6309. October Term, 1937.

THE ELECTRIC STORAGE BATTERY CO.,
Defendant-Appellant,

v.

GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION,
Plaintiffs-Appellees.

Petition of Defendant-Appellant for Rehearing and Supporting Brief.

AUGUSTUS B. STOUGHTON,
HUGH M. MORRIS,
A. F. KWIS,
E. S. W. FARNUM, JR.,
Counsel for Defendant-Appellant.

International, 236 Chestnut St., Philadelphia

INDEX.

Page

PETITION OF DEFENDANT-APPELLANT FOR REHEARING 1

DEFENDANT'S SUPPORTING BRIEF 5

ARGUMENT:

I. THIS HONORABLE COURT INADVERTENTLY OVERLOOKED THE FACT THAT THE VERY PROCESS HERE HELD TO BE AN INFRINGEMENT OF PLAINTIFF'S '150 PATENT WAS, BY THE EXPRESS FINDING OF THE COURT BELOW, IN COMMERCIAL USE IN DEFENDANT'S HARDINGE MILL IN JUNE, 1921, MORE THAN TWO YEARS PRIOR TO THE FILING OF APPLICATION FOR '150, AND THAT SUCH PRIOR COMMERCIAL USE INVALIDATES '150 UNDER THE EXPRESS TERMS OF R. S. 4887 5

II. THIS HONORABLE COURT INADVERTENTLY OVERLOOKED THE FACT THAT PLAINTIFF'S '150 PATENT IS INVALIDATED, UNDER THE EXPRESS TERMS OF R. S. 4887, FOR THE REASON THAT, AS FOUND BY THE COURT BELOW, THE PROCESS THEREOF WAS KNOWN AND USED IN DEFENDANT'S HARDINGE MILL PRIOR TO THE EARLIEST DATE TO WHICH PLAINTIFF CAN CARRY BACK THE INVENTION OF '150, EITHER IN FACT OR IN LAW 8

III. ALTHOUGH THIS COURT CONCURRED IN THE FINDING OF THE COURT BELOW THAT COMMERCIAL PRODUCTION BY DEFENDANT'S HARDINGE MILL, "WHICH EMBODIED THE PLAINTIFF'S PRINCIPLES," BEGAN IN JUNE, 1921, IT INADVERTENTLY OVERLOOKED THE FACT THAT SUCH FINDING INVALIDATES PLAINTIFF'S '020 PATENT UNDER THE EXPRESS TERMS OF R. S. 4886 15

IV. IN AFFIRMING THE HOLDING OF THE COURT BELOW THAT PLAINTIFF'S '149 PATENT IS VALID AND INFRINGED, THIS HONOR-

INDEX—Continued.

Page

ABLE COURT INADVERTENTLY OVERLOOKED THE FACT THAT JAPANESE PATENT 41,728 IS SUBSTANTIALLY IDENTICAL WITH CLAIM 1 OF '149 AND THAT JAPANESE PATENT 42,563 IS SUBSTANTIALLY IDENTICAL WITH CLAIM 2 OF '149 AND THAT THOSE PATENTS, HAVING BEEN APPLIED FOR IN JAPAN MORE THAN TWELVE MONTHS PRIOR TO THE FILING OF APPLICATION FOR '149, NULLIFY '149 UNDER THE EXPRESS TERMS OF R. S. 4887.. 17

V. IN ITS AGREEMENT WITH THE CONCLUSION OF THE COURT BELOW THAT DEFENDANT'S TUDOR MILL OPERATION, THOUGH NOT AN ABANDONED EXPERIMENT, "CANNOT BE CONSIDERED AS A PRIOR PUBLIC USE AGAINST THE PATENTS IN SUIT" BECAUSE "THERE WAS ABSOLUTELY NO SUGGESTION OR THOUGHT OF BLOWING OR FORCING THE AIR INTO THE DRUM" AND BECAUSE "THE DEFENDANT NEVER HAD THE SLIGHTEST CONCEPTION OF THE EFFECT WHICH EVEN THIS GENTLE CIRCULATION OF AIR HAD UPON THE LEAD SURFACE TO BE ABRADED," THIS HONORABLE COURT INADVERTENTLY OVERLOOKED THE POSITIVE DOCUMENTARY EVIDENCE WHICH CLEARLY ESTABLISHES THE CONTRARY.. 19

VI. THIS HONORABLE COURT APPARENTLY OVERLOOKED THE FACT THAT THE FINDING BY THE COURT BELOW OF INFRINGEMENT OF PLAINTIFF'S '149 PATENT BY DEFENDANT'S HARDINGE MILL PROCESS IS CONCLUSIVELY REFUTED BY THE CLEAR PREPONDERANCE OF EVIDENCE.. 22

CONCLUSION 24

IN THE

United States Circuit Court of Appeals

FOR THE THIRD CIRCUIT.

THE ELECTRIC STORAGE BATTERY CO., *Defendant-Appellant*, v. GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION, *Plaintiffs-Appellees.*	No. 6309. October Term, 1937.

PETITION OF DEFENDANT-APPELLANT FOR REHEARING.

Now comes The Electric Storage Battery Co., defendant-appellant in the above-entitled cause, and respectfully prays that said cause be reheard and reconsidered by this Honorable Court, for the following reasons:

(1) This Honorable Court inadvertently overlooked the fact that the very process here held to be an infringement of plaintiff's '150 patent was, by the express finding of the court below, in commercial use in defendant's Hardinge mill in June, 1921, more than two years prior to the filing of application for '150, and that such prior commercial use invalidates '150 under the express terms of R. S. 4887.

(2) This Honorable Court inadvertently overlooked the fact that plaintiff's '150 patent is invalidated, under the express terms of R. S. 4887, for the reason that, as found by the court below, the process thereof was known and used in defendant's Hardinge

mill prior to the earliest date to which plaintiff can carry back the invention of '150, either in fact or in law.

(3) Although this court concurred in the finding of the court below, that commercial production by defendant's Hardinge mill, "which embodied the plaintiff's principles," began in June, 1921, it apparently overlooked the fact that such finding invalidates plaintiff's '020 patent under the express terms of R. S. 4886.

(4) In affirming the holding of the court below that plaintiff's '149 patent is valid and infringed, this Honorable Court inadvertently overlooked the fact that Japanese Patent 41,728 is substantially identical with claim 1 of '149 and that Japanese Patent 42,563 is substantially identical with claim 2 of '149 and that those patents, having been applied for in Japan more than twelve months prior to the filing of application for '149, nullify '149 under the express terms of R. S. 4887.

(5) In its agreement with the conclusion of the court below that defendant's Tudor mill operation, though not an abandoned experiment, "cannot be considered as a prior public use against the patents in suit" because "there was absolutely no suggestion or thought of blowing or forcing the air into the drum" and because "the defendant never had the slightest conception of the effect which even this gentle circulation of air had upon the lead surface to be abraded," this Honorable Court inadvertently overlooked the positive documentary evidence which clearly establishes the contrary.

(6) This Honorable Court apparently overlooked the fact that the finding by the court below of infringement of plaintiff's '149 patent by defendant's Har-

dinge mill process is conclusively refuted by the clear preponderance of evidence.

Wherefore, defendant-appellant prays that said cause be reheard and reconsidered by this Honorable Court upon the grounds and for the reasons aforesaid.

AUGUSTUS B. STOUGHTON,
HUGH M. MORRIS,
A. F. KWIS,
E. S. W. FARNUM, JR.,
Counsel for Defendant-Appellant.

CERTIFICATE OF COUNSEL.

I hereby certify that this petition for rehearing is not filed for purposes of delay and is, in my opinion, well founded in law.

AUGUSTUS B. STOUGHTON,
Solicitor and Of Counsel for Defendant-Appellant.

1234

DEFENDANT'S SUPPORTING BRIEF.

ARGUMENT.

I.

THIS HONORABLE COURT INADVERTENTLY OVERLOOKED THE FACT THAT THE VERY PROCESS HERE HELD TO BE AN INFRINGEMENT OF PLAINTIFF'S '150 PATENT WAS, BY THE EXPRESS FINDING OF THE COURT BELOW, IN COMMERCIAL USE IN DEFENDANT'S HARDINGE MILL IN JUNE, 1921, MORE THAN TWO YEARS PRIOR TO THE FILING OF APPLICATION FOR '150, AND THAT SUCH PRIOR COMMERCIAL USE INVALIDATES '150 UNDER THE EXPRESS TERMS OF R. S. 4887.

R. S. 4887 (35 U. S. C. A. § 32) deals with the effect, upon a domestic application, of a patent previously secured in a foreign country for the same invention and of the application for such foreign patent.

It says:

> "No person otherwise entitled thereto shall be debarred from receiving a patent for his invention . . ., nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented by the inventor or his legal representatives or assigns in a foreign country, unless the application for said foreign patent was filed more than twelve months, . . . prior to the filing of the application in this country, in which case no patent shall be granted in this country."

And,

> "An application for patent for an invention . . . filed in this country by any person who has previously regularly filed an application for a pat-

> ent for the same invention, . . . in a foreign country . . . shall have the same force and effect as the same application would have if filed in this country on the date on which the application for patent for the same invention, . . . was first filed in such foreign country: Provided, That the application in this country is filed within twelve months . . . . from the earliest date on which any such foreign application was filed."

The statute thus operates to deprive a foreign patent of the anticipating effect which, under R. S. 4886, it might otherwise have upon a domestic application for the same invention, provided the application in this country is filed within twelve months from the date of filing of the foreign application; and, under like conditions, it gives to a domestic application the benefit of the foreign application date.

But these exceptions to R. S. 4886 are not absolute. They are subject to the mandatory limitation with which the act concludes:

> "But no patent shall be granted on an application for patent for an invention or discovery or a design which had been patented or described in a printed publication in this or any foreign country more than two years before the date of the *actual filing* of the application in this country, *or which had been in public use or on sale in this country for more than two years prior to such filing.*"*

Commenting on this statute, Stringham, Outline of Patent Law (1937), says (§ 1780):

> "A convention filing has, in general, the effect of an earlier domestic filing, *but it does not prevent the running of the two-year statutory bar.*"

The court below held Claims 1 to 4, 6 and 9 to 13 of United States Patent '150, (being all of the process claims of that patent in suit) valid and infringed, and found:

---

*Italics throughout defendant's.

"In July, 1920, the defendant set about installing a full-sized plant for the manufacture of lead powder at Philadelphia. Mr. Hall was engaged for that purpose. . . . he decided upon what he referred to as a 'radical change' from the German mill. As a matter of fact, he discarded it altogether and proceeded to install an entirely different type, *which embodied the plaintiff's principles and in which the principal element was a Hardinge conical mill.* (R. II, 1174.)

. . . . . .

". . . *Commercial production by the Hardinge mill with its forced air draft undoubtedly involved the use of the plaintiff's patent, and June, 1921, may be fixed as the date when that began.*" (R. II, 1175.)

There was thus an express, positive and unqualified finding and conclusion by the court below, concurred in by this court, that defendant's Hardinge mill embodied the principles and involved the use of the process claims of '150, and that such Hardinge mill was in public use in Philadelphia not later than June, 1921.

But plaintiff's '150 patent was not applied for until July 14, 1923 (PX 3). Consequently, the application for '150 was not filed until the invention thereof "had been in public use . . . in this country for more than two years prior to such filing." It is believed this fact was inadvertently overlooked by the court.

II.

THIS HONORABLE COURT INADVERTENTLY OVERLOOKED THE FACT THAT PLAINTIFF'S '150 PATENT IS INVALIDATED, UNDER THE EXPRESS TERMS OF R. S. 4887, FOR THE REASON THAT, AS FOUND BY THE COURT BELOW, THE PROCESS THEREOF WAS KNOWN AND USED IN DEFENDANT'S HARDINGE MILL PRIOR TO THE EARLIEST DATE TO WHICH PLAINTIFF CAN CARRY BACK THE INVENTION OF '150, EITHER IN FACT OR IN LAW.

By the unequivocal finding of the court below, which this court deemed "based upon substantial evidence," the process of '150 was in use in commercial production by defendant's Hardinge mill in Philadelphia not later than June, 1921. *A fortiori*, the process of '150 was then known and used by others than plaintiff in this country, and, by the express terms of R. S. 4886, Patent '150 is thereby invalidated, unless plaintiff can establish a date of invention therefor, to which he is legally entitled, prior to June, 1921. But that he cannot do, either (a) in fact, or (b) in law.

(a) The court below thus analyzed the process of '150 (R. II, 1167):

> "It calls for the following steps:
>
> 1. *Impinging a current of air* on lead masses in a dry state;
> 2. Abrading the lead masses;
> 3. Controlling the temperature to obtain a finely divided powder containing a large proportion of *oxidized* lead."

The court below found (R. II, 1175):

> "The essence of the plaintiff's patent, . . . is forcing a continuous blast of air into the drum at a

controlled high temperature so that *oxygen* will be absorbed by the lead and form a brittle *oxidized* surface which could be rapidly abraded off."

Thus, it was found by the court below that the central and indispensable element of plaintiff's invention is the *oxidizing* effect of the air introduced into the drum.

The court below surmised (R. II, 1165) that plaintiff, "with the scientific resources and expert assistance at his command," "must have known that oxidation would be accelerated by the introduction of the air current" and accordingly fixed the date of invention and successful reduction to practice as not later than August, 1919, remarking:

> "I think it clear that he (Shimadzu) had enough appreciation of what was necessary to obtain the desired result for me to fix the date of invention at or before the time referred to." (R. II, 1166.)

If, therefore, it is true that plaintiff did, in August, 1919, perceive the *oxidizing* effect of the air, he must have had the same knowledge on November 27, 1920, when he filed application for Japanese Patent 42,563.

But, with respect to Japanese Patent '563, the court below said:

> "The first thing that strikes one is that there is not the slightest suggestion of any *oxidizing* effect of the current of gas which is introduced into the mill. On the contrary, it would seem that there was a definite purpose to avoid *oxidation.*" (R. II, 1169.)

And,

> "The best guess that one can make of what he had in mind was, that he meant to patent a process for mechanically removing fine powder from the drum by means of a current of some non-oxi-

dizing medium, and that he believed that air with its high percentage (78%) of nitrogen, if delivered at a low temperature, would be sufficiently inert to serve his purpose and prevent combustion with the drum." (R. II, 1170.)

These findings, which apparently escaped the attention of this court, demonstrate, it is believed, that plaintiff did not perceive the *oxidizing* effect of the air introduced into the drum (the sine qua non of the '150 process) on November 27, 1920 and, consequently, that he had not and could not have attained the invention of that patent in August, 1919.

The exact date when plaintiff did arrive at the basic concept of the invention, however, is not in doubt. It is conclusively established by the unassailable documentary evidence adduced by plaintiffs themselves in PX 11. That exhibit is a photograph showing the appearance of lead balls after seven hours rumbling in an atmosphere of carbon dioxide. No powder was produced. The balls were merely polished (R. I, 151, 173). The test was made by Shimadzu "to find out what the air does" (R. I, 178). At the trial Ishimura testified that the experiment of Exhibit 11 was conducted in 1919 (R. I, 151, 152, 173) or 1921 (R. I, 178). Subsequently, while putting the record in form for this appeal, defendant discovered that PX 11 itself records the date on which the carbon dioxide experiment was made, and that that date was *January 27, 1923.**

On February 3, 1923, scarcely more than a week after the experiment of PX 11, plaintiff filed in Japan

*In their answer, filed in this Court to defendant's petition for leave to apply to the District Court to reopen the case and take new evidence, plaintiff, referring to the label on the bottle in PX11, stated:

"A correct translation reads as follows:

'Carbon Dioxide Gas Experiment 12th year of Taisho, 1st month, 27th day, The lead balls after 7 hours rotation.'

Taisho (the reign of the Old Emperor Yoshihito), began in July, 1912, so the 12th year of Taisho would be the year 1923 . . ."

application for Patent 60,825, which the court below found "corresponds very closely with U. S. '150."

Could there be any more convincing proof that plaintiff's conception of the very heart of the '150 process was simultaneous with the experiment of PX 11 and had not been attained before January 27, 1923, long after the invention was known and used in defendant's Hardinge mill, which the court found to be in commercial production in June, 1921.

Yet that evidence apparently escaped the attention of this court.

(b) But even if it be assumed, notwithstanding the foregoing evidence, that the process of '150 was conceived and actually reduced to practice by plaintiff in Japan prior to June, 1921, nevertheless, plaintiff cannot, under the law, carry the date of his invention of '150 back of the date on which application for Japanese Patent 60,825 for the invention was first filed in Japan. That date was February 3, 1923. But, as found by the court below, the process of '150 had then been known and used in this country in defendant's Hardinge mill since at least as early as June, 1921.

The court below found that Japanese Patent 60,825 "corresponds very closely with U. S. '150" (R. II, 1172). '150 was granted May 11, 1926, upon application filed July 14, 1923 (PX 3). Japanese Patent 60,825 was granted June 19, 1924 upon application filed February 3, 1923. (PX 61.)

We are therefore here concerned solely with the rights in this country of an inventor who has first patented or caused the invention to be patented in a foreign country. Such rights are expressly governed by R. S. 4887. That statute says:

> "An application for patent for an invention . . . filed in this country by any person who has previously regularly filed an application for a pat-

> ent for the same invention . . . in a foreign country, . . . shall have the same force and effect as the same application would have if filed in this country on the date on which the application for patent for the same invention, . . . was first filed in such foreign country: Provided, That the application in this country is filed within twelve months . . . from the earliest date on which any such foreign application was filed."

Assuming, as the court below found, that the invention of Japanese Patent '825 is the same as U. S. '150, R. S. 4887 thus gives to plaintiff's application for '150 the benefit of the filing date of the Japanese '825. But the statute likewise operates, according to the great weight of authority, as an absolute limitation upon the right of plaintiff to carry the date of invention back of the date of filing of the Japanese application.

Wilson v. Sherts, 81 F. (2d) 755.

Rebuffat v. Crawford, 68 F. (2d) 980, 982.

De Kando v. Armstrong, 37 App. D. C. 314.

Westinghouse Mach. Co. v. General Electric Co., 207 F. 75.

Jay v. Weinberg, 250 F. 469, aff'd 262 F. 973.

Patents Selling & Exporting Co. v. Dunn, 213 F. 40.

Vacuum Engineering Co. v. Dunn, 209 F. 219.

The court below held (R. II, 1178):

> "The plaintiff is undoubtedly entitled to rely for priority upon the date of invention and reduction to practice as found, regardless of the fact that the invention was made in a foreign country."

upon the authority of *Claude Neon Lights v. Rainbow Light*, 47 Fed. (2d) 345 and *Hanifen v. E. H. Godshalk*, 78 Fed. 811.

But neither of those cases can be considered as an authoritative decision upon the point in question or as casting doubt upon the soundness of the established construction of the statute.

The conclusion reached by Judge Campbell in 47 Fed. (2d) is based upon the cases of *Welsbach Light Co. v. American Incandescent Lamp Co.*, 98 Fed. 613; *Hanifen v. E. H. Godshalk*, 78 Fed. 811; *Hanifen v. Price*, 96 Fed. 435 and 102 Fed. 509; and *Badische Anilin & Sode Fabrik v. A. Klipstein & Co.*, 125 Fed. 543.

But with the exception of *Hanifen v. E. H. Godshalk Co.*, 78 Fed. 811, and *Hanifen v. Price*, 96 Fed. 435, none of the cases referred to by Judge Campbell supports the proposition for which it is cited. On the contrary, such cases squarely conform to the established rule that a foreign inventor may take back the date of his invention upon an issue of priority only to the date of the actual filing of his application for a foreign patent.

Thus, in *Welsbach Light Co. v. American Incandescent Lamp Co.*, 98 Fed. 613, 616, the C. C. A. 2 said:

> "Our conclusion is that, as against an infringer, the patentee in a United States patent for an invention previously made by him and patented in a foreign country may, to avoid alleged use in this country by an infringer before the date of the foreign patent, *show the date of the application for the foreign patent, for the purpose of showing the actual date of his invention in a foreign country.*"

In *Hanifen v. Price*, 102 Fed. 509, the precise question was not considered by the court.

And, in *Badische Anilin & Sode Fabrik v. A. Klipstein & Co.*, 125 Fed. 543, 552, the holding was identical with that in the *Welsbach* case.

The decision in *Hanifen v. Price*, 96 Fed. 435 was reversed by the C. C. A. 2, 102 Fed. 509. The district court, however, followed the reasoning of Judge Dallas in the earlier case of *Hanifen v. E. H. Godshalk Co.*, 78 Fed. 811, and its conclusion upon the question is therefore dependent for its authority upon the decision of Judge Dallas. That decision was likewise reversed by this court in 84 Fed. 649, upon other grounds. But apart from that fact, the decision is wholly without pertinency or effect upon the question here involved. The case was decided December 16, 1896. R. S. 4887 then stood as originally enacted in 1870, and provided only that:

> "No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid, by reason of its having been first patented or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States for more than two years prior to the application."

As thus enacted, the statute obviously was not concerned with any limitation upon the right of a foreign patentee to secure a patent in this country for the same invention, other than by the limitation, carried into the present statute, that the invention shall not have been in public use in this country for more than two years prior to the application here, or with the effect of the application for such foreign patent. The court was therefore justified in stating:

> "There is no statute which warrants the suggested distinction respecting inventions made abroad and those made in the United States."

The case, therefore, has no application to R. S. 4887 as presently amended by the Acts of March 3, 1903 and June 19, 1936, and cannot be considered as a

precedent for the construction of the statute here involved. For the same reason, the case of *Hanifen v. Price*, 96 Fed. 435, cannot be regarded as an authority upon the present question.

The foregoing considerations, which invalidate Patent '150 under R. S. 4887, were, it is believed, inadvertently overlooked by this court.

III.

ALTHOUGH THIS COURT CONCURRED IN THE FINDING OF THE COURT BELOW THAT COMMERCIAL PRODUCTION BY DEFENDANT'S HARDINGE MILL, "WHICH EMBODIED THE PLAINTIFF'S PRINCIPLES," BEGAN IN JUNE, 1921, IT INADVERTENTLY OVERLOOKED THE FACT THAT SUCH FINDING INVALIDATES PLAINTIFF'S '020 PATENT UNDER THE EXPRESS TERMS OF R. S. 4886.

The court below held Claims 10 and 11 of plaintiff's '020 patent (being all of the claims thereof in suit) valid and infringed and found (R. II, 1188-9), upon what this court characterized as substantial evidence:

> "The apparatus patent ('020) is closely related, of course, to the process patents. Practically all of the considerations which apply to the one apply to the other, including the Tudor mill and other alleged prior art structures. Having held the process claims valid and infringed, the same conclusion is reached with regard to the apparatus patent."

'020 has no counterpart in any foreign patent here in evidence. The validity of that patent is therefore governed by R. S. 4886 (35 U. S. C. A. § 31), unaffected by any right or limitation arising out of the filing of a prior foreign application, under R. S. 4887.

Under R. S. 4886, two years prior public use of an invention in this country is an absolute bar to the validity of a patent for the invention issued upon an application filed thereafter, irrespective of when or where the inventive act occurred. The statute applies to foreign and domestic inventors without distinction.

It says:

> "*Any* person who has invented . . . any new and useful . . . machine . . . *not in public use . . . in this country for more than two years prior to his application,* may . . . obtain a patent therefor."

By the express finding of the court below, concurred in by this court, the invention of '020 was in public use in this country in defendant's Hardinge mill "which embodied the plaintiff's principles" not later than *June, 1921.*

But, the application for '020 was not filed until *April 27, 1926.*

This fact, it is believed, escaped the attention of this court.

IV.

IN AFFIRMING THE HOLDING OF THE COURT BELOW THAT PLAINTIFF'S '149 PATENT IS VALID AND INFRINGED, THIS HONORABLE COURT INADVERTENTLY OVERLOOKED THE FACT THAT JAPANESE PATENT 41,728 IS SUBSTANTIALLY IDENTICAL WITH CLAIM 1 OF '149 AND THAT JAPANESE PATENT 42,563 IS SUBSTANTIALLY IDENTICAL WITH CLAIM 2 OF '149 AND THAT THOSE PATENTS, HAVING BEEN APPLIED FOR IN JAPAN MORE THAN TWELVE MONTHS PRIOR TO THE FILING OF APPLICATION FOR '149, NULLIFY '149 UNDER THE EXPRESS TERMS OF R. S. 4887.

Claim 1 of '149 is:

"(1) A method of forming a finely divided chemically reactive lead powder of such fineness and activity as to be readily changed chemically on contact with air, which comprises introducing relatively large masses of lead into a rotatable vessel, rotating said vessel at a relatively low speed and forming said lead powder by attrition of said lead masses resulting from the rubbing of said masses against each other."

Claim 1 of Japanese Patent '728 is:

"(1) In order to achieve the purpose recorded above; a method of manufacturing chemically reactive lead powde is claimed, a special feature of which is throwing lumps of lead into a rotating vessel and by rotation of the vessel grinding the lumps of lead to small pieces."

Claim 2 of '149 is:

"2. A method of forming a finely divided chemically reactive lead powder of such fineness and activity as to be readily changed chemically on exposure to air, which comprises introducing relatively large masses of lead into a rotatable

vessel, rotating said vessel at a relatively low speed, *introducing a current of air into said vessel*, forming said lead powder by attrition of said lead masses resulting from the rubbing of said lead masses against each other, and removing the said powder from said vessel by means of said current of air."

Claim 1 of Japanese Patent '563 is:

"1. In order to achieve the object recorded earlier in this record, a method of manufacturing chemically reactive lead powder is claimed, a special feature of which is throwing lumps of lead into a rotating vessel, and *blowing currents of air* or other inactive gasses *into the vessel* during rotation to force the small particles produced by rubbing out of the vessel."

Moreover, claim 2 of Japanese patent '563 refers merely to "currents of inblowing *air*," and claim 3 thereof speaks only of the "force of the wind."

Substantial identity of claims only is required to make applicable the twelve months limitation of R. S. 4887. *United Shoe Machinery Co. v. Duplessis Shoe Machinery Co.*, 148 Fed. 31, affirmed (C. C. A. 1) 155 Fed. 842. The foregoing respective claims are virtually identical in form as well as in substance.

Moreover, it is not necessary that every element and feature of the patent shall be clearly shown by a single foreign patent, but several such references may be combined to negative patentability of the claims. *In re Mulligan*, 83 Fed. (2d) 917.

Japanese Patent '728 was applied for *November 21, 1920* (DX 111).

Japanese Patent '563 was applied for *November 27, 1920* (DX 112).

Application for '149 was filed *January 30, 1922* (PX 2). '149 is, therefore, invalidated by Japanese

Patents '728 and '563 under the express terms of R. S. 4887.

The court below did not discuss Japanese Patent '563 in relation to '149. It made no mention whatever in its opinion of Japanese Patent '728.

These facts, it is believed, were overlooked by this court.

V.

IN ITS AGREEMENT WITH THE CONCLUSION OF THE COURT BELOW THAT DEFENDANT'S TUDOR MILL OPERATION, THOUGH NOT AN ABANDONED EXPERIMENT, "CANNOT BE CONSIDERED AS A PRIOR PUBLIC USE AGAINST THE PATENTS IN SUIT" BECAUSE "THERE WAS ABSOLUTELY NO SUGGESTION OR THOUGHT OF BLOWING OR FORCING THE AIR INTO THE DRUM" AND BECAUSE "THE DEFENDANT NEVER HAD THE SLIGHTEST CONCEPTION OF THE EFFECT WHICH EVEN THIS GENTLE CIRCULATION OF AIR HAD UPON THE LEAD SURFACE TO BE ABRADED," THIS HONORABLE COURT INADVERTENTLY OVERLOOKED THE POSITIVE DOCUMENTARY EVIDENCE WHICH CLEARLY ESTABLISHES THE CONTRARY.

With respect to defendant's Tudor mill operation, the court below found:

> "Finally, in July, 1915, the defendant bought a Tudor mill duplicating those seen by their engineer in Germany and set it up in its plant, putting it into operation *about the middle of 1916.* . . . Various runs were made for the purpose of obtaining a product and in 1917 and 1918 batteries constructed from the powder were sold to New York Railways Company. The first order was for 70 sets of bat-

teries at a price of $65,000 comprising some 16,000 plates. A second order was for about a fifth of that amount." (R. II, 1173.)

. . . . . .

". . . I cannot agree with the plaintiff that the whole incident must be dismissed as an abandoned experiment. . . . There is nothing to indicate that the product was not satisfactory, but the mill never produced powder in sufficient quantity to justify its *continuation in commercial use*. Nevertheless, I think it might stand as a prior public use against the plaintiff's patents, provided it really anticipated the plaintiff's invention . . . . (R. II, 1174).

The court below thus found and held that the Tudor mill was in *commercial use* in defendant's Philadelphia plant in 1917 and 1918; that it was not an abandoned experiment; and that it might stand as a prior public use against plaintiff's patents, if it anticipated plaintiff's invention. Upon the latter question the court below said:

". . . I am of the opinion that it cannot be considered as a prior public use against the patents in suit, because its entire operation failed even to approximate the essential idea of the plaintiff's process patent. . . . if the method of operation be carefully considered it will be seen how far away from the spirit it is." (R. II, 1175.)

This conclusion the court below predicated solely upon the finding that:

"There was absolutely no suggestion or thought of blowing or forcing the air into the drum." (R. II, 1176.)

And,

"The defendant never had the slightest conception of the effect which even this gentle circulation of air had upon the lead surfaces to be abraded. The correlation between oxidation in the drum and increased yield was not perceived." (R. II, 1176.)

But in so finding and holding, the court below apparently disregarded the unquestioned documentary evidence which conclusively establishes the contrary.

DX 78 is dated July 24, 1917. It represents a report made to defendant on that date by Mr. Kershaw, the engineer in immediate charge of the operation of the Tudor mill. It is set out verbatim on pages 19 to 22 of defendant's main brief. It records the results of experiments made with the Tudor mill. It conclusively shows that defendant fully appreciated the oxidizing effect of the circulation of air upon the lead surfaces to be abraded, and correlation between oxidation in the drum and increased yield.

Thus, DX 78 states:

> ". . . . the greater the *internal ventilation through the machine* the greater the speed at which it can be operated without exceeding its temperature limit, thus increasing the ease of control and the *output.*"

Again, under the heading "GENERAL OPERATIONS," DX 78 states:

> *"Control the character of the product as far as possible by the external and internal ventilation systems, installing fans if necessary."*

DX78, moreover, establishes the identity between defendant's Tudor mill and the process of plaintiff's '150 patent.

Thus it shows an operating load of 1800 to 2400 pounds at a speed of 12.5 to 15 revolutions per minute, and at a temperature ranging from 165 to 185° F. (73.9-85° C.) and the production under those conditions of 40 to 60 pounds of lead dust per hour having a lead oxide content of 60 to 80%.

Furthermore, the evidence shows that the construction of the mill was the precise construction of the mill described in '150, being a rotatable cylinder having its walls pierced all over with one-eighth inch holes (R. I, 444, 445). The Tudor mill had, however, a length of 36¾" instead of 60" (R. I, 444).

Defendant's Tudor mill was in *commercial use* in this country in 1917 and 1918. The process thereof was therefore known and used in this country before the earliest date found for plaintiff's invention of the process of '150, which the court below fixed as August, 1919. Likewise, defendant's Tudor mill was in public use in this country for more than two years before the filing of application for any of the patents in suit, the earliest of which was filed January 30, 1922. Upon both grounds the Tudor mill invalidates plaintiff's '149, '150 and '020 patents under the express terms of R. S. 4886.

These facts, established by incontrovertible documentary evidence, were, it is believed, inadvertently overlooked by this court.

VI.

THIS HONORABLE COURT APPARENTLY OVERLOOKED THE FACT THAT THE FINDING BY THE COURT BELOW OF INFRINGEMENT OF PLAINTIFF'S '149 PATENT BY DEFENDANT'S HARDINGE MILL PROCESS IS CONCLUSIVELY REFUTED BY THE CLEAR PREPONDERANCE OF EVIDENCE.

The court below held defendant's Hardinge mill process to be an infringement of the process claims of '150, which call for:

"1. Impinging a current of air on lead masses in a dry state;

2. Abrading the lead masses;

3. Controlling the temperature to obtain a finely divided powder containing a large proportion of *oxidized* lead." (R. II, 1167.)

Yet the court below likewise found defendant's Hardinge mill process to be also an infringement of plaintiff's '149 patent, although it expressly recognized that " '149 does not disclose the oxidizing function of the air or refer to the highly important element of the process having to do with the temperature control necessary to its successful operation." (R. II, 1188.)

In so holding, the court below not only failed to give effect to the foregoing distinction between the process of '149 and that of '150, expressly recognized in its opinion, but also failed to give effect to the other evidence which conclusively establishes non-infringement of '149 by defendant's Hardinge mill process.

Thus, the evidence clearly shows that the product of '149 is a *metal* powder, not a powder of lead oxide intermingled with powder of metallic lead.

Again, patent '149 discloses that the heat generated by friction is to be radiated and that the powder is to be removed from the mill as soon as it is formed; whereas, defendant does not operate at room temperature, but at temperatures above 60° C.

Defendant, moreover, does not blow its powder out of the mill as soon as it is formed. It permits the powder to remain in the mill for a long period of time and until it is discharged by the classifying action of the mill. The function of the air used by defendant is not to blow the product out of the mill at any time. On the contrary, the sole purpose of air introduced into defendant's mill is oxidation (R. I, 482).

These facts, it is believed, escaped the attention of this Honorable Court.

CONCLUSION.

Defendant's plant is old. It has been operating in the same manner that it is now operating since at least as early as June, 1921.

For the reasons hereinbefore set forth it appears that this Honorable Court inadvertently overlooked and failed to give effect to the clear, mandatory principles of law applicable to the express findings by the court below, in which this court concurred, under the express terms of R. S. 4886 and R. S. 4887.

For this court to permit defendant's plant to be closed by injunction, in the light of the foregoing considerations and until those matters have been given full and mature consideration by this court upon rehearing, would, it is submitted, result in grave injustice.

Defendant therefore prays that it be granted a rehearing as to each of the matters above specified.

All of which is

Respectfully submitted,

AUGUSTUS B. STOUGHTON,
HUGH M. MORRIS,
A. F. KWIS,
E. S. W. FARNUM, JR.,
Counsel for Defendant.

ORDER DENYING PETITION FOR REHEARING.

(Filed September 14, 1938.)

IN THE UNITED STATES CIRCUIT COURT OF APPEALS,
FOR THE THIRD CIRCUIT.

No. 6309. March Term, 1938.

The Electric Storage Battery Co.,
Defendant-Appellant,

v.

Genzo Shimadzu and Northeastern Engineering Corp.,
Plaintiffs-Appellees.

SUR PETITION FOR REHEARING.

AND NOW, to wit, September 14, 1938, after due consideration, the petition for rehearing in the above-entitled case is hereby denied.

Philadelphia,

J. WARREN DAVIS,
Circuit Judge.

(Endorsements.)—Order Denying Petition for Rehearing Received and Filed September 14, 1938. Wm. P. Rowland, Clerk.

CLERK'S CERTIFICATE.

UNITED STATES OF AMERICA,
EASTERN DISTRICT OF PENNSYLVANIA, } *Sct.*
THIRD JUDICIAL CIRCUIT,

I, WM. P. ROWLAND, Clerk of the United States Circuit Court of Appeals for the Third Circuit, DO HEREBY CERTIFY the foregoing to be a true and faithful copy of the original Transcript of Record (in two volumes) and proceedings in this Court in the case of Electric Storage Battery Co., Defendant-Appellant, v. Genzo Shimadzu and Northeastern Engineering Corp., Plaintiffs-Appellees, No. 6309, on file, and now remaining among the records of the said Court, in my office.

IN TESTIMONY WHEREOF, I have hereunto subscribed by name and affixed the seal of the said Court, at Philadelphia, this twenty-
(Seal) first day of September, in the year of our Lord one thousand nine hundred and thirty-eight and of the Independence of the United States the one hundred and sixty-third.

WM. P. ROWLAND,
Clerk of the U. S. Circuit Court of Appeals, Third Circuit.

SUPREME COURT OF THE UNITED STATES

ORDER ALLOWING CERTIORARI—Filed December 5, 1938

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Third Circuit is granted.

And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.

Vol. III

TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1938

No. 441

THE ELECTRIC STORAGE BATTERY CO.,
PETITIONER,

vs.

GENZO SHIMADZU AND NORTHEASTERN ENGINEERING CORPORATION

ON WRIT OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE THIRD CIRCUIT

PETITION FOR CERTIORARI FILED OCTOBER 27, 1938.

CERTIORARI GRANTED DECEMBER 5, 1938.



INDEX TO EXHIBITS.

	Page
Plaintiffs' Exhibit No. 1—United States Patents:	
No. 1,548,149, Genzo Shimadzu, Dated May 11, 1926	1
No. 1,584,150, Genzo Shimadzu, Dated May 11, 1926	3
No. 1,584,151, Genzo Shimadzu, Dated May 11, 1926	7
No. 1,584,152, Genzo Shimadzu, Dated May 11, 1926	9
No. 1,584,479, Genzo Shimadzu, Dated May 11, 1926	11
No. 1,896,020, Genzo Shimadzu, Dated January 31, 1933	13
Plaintiffs' Exhibit No. 61—Translation of Japanese Patent No. 60,825 to Genzo Shimadzu, Dated June 19, 1924	21
Defendant's Exhibit No. 78—Copy of Report, Dated July 24, 1917, "Lead Dust Manufacture"	26
Defendant's Exhibit No. 111—Translation of Japanese Patent No. 41,728 to Genzo Shimadzu, Dated February 13, 1922	30
Defendant's Exhibit No. 112—Translation of Japanese Patent No. 42,563 to Genzo Shimadzu, Dated May 10, 1922	33
Plaintiffs' Exhibit No. 17—United States Patent No. 1,675,345 to C. A. Hall, Dated July 3, 1928	37
Plaintiffs' Exhibit No. 18—United States Patent No. 1,888,823 to C. A. Hall, Dated November 22, 1932	41
Clerk's Certificate	45

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Patented May 11, 1926. 1,584,149

UNITED STATES PATENT OFFICE.

GENZO SHIMADZU, OF KYOTO, JAPAN.

METHOD OF MANUFACTURING METAL POWDER.

No Drawing. Application filed January 30, 1922. Serial No. 532,220.

The present invention relates to a method of manufacturing fine powder of a plastic metal, by putting the plastic metal such as lead, in pieces in a rotatable vessel, and rotating the vessel so as to cause friction of the metal lumps with each other and with the inner surface of the vessel thereby effecting the abrasion of the metal pieces. The object of this invention is to manufacture spongy chemically re-active, fine lead powder by a simple and cheap process without crushing the same as has hitherto been the case.

Hitherto, the manufacture of metal powder has been done either by crushing or grinding the material or by a method, as in the case of manufacture of zinc dust, which consists in cooling a mixture of zinc vapour with air so that the metal coagulates into a fine powder.

The products of these old processes, however, are coarse-grained and liable to harden on the surface layer. Besides, while the particles of the powder obtained by crushing or grinding are generally pressed flat and are therefore with difficulty acted upon by chemicals, the powder obtained by atomizing and cooling process is only a relatively coarse product, which is not chemically reactive. Also the powder which is obtained by filing is not only coarse-grained, but is liable to be impaired in its purity by the mixture of the particles which wear off from the files themselves.

Thus the former products are not best adapted for use in special chemical purposes, which are aimed at in the present invention.

The present invention consists in rotating a rotatable vessel, containing lumps of metallic lead, in such a manner that the metal lumps rub against one another, and the inner surface of the vessel, causing abrasion and pulverization of the lumps. The degree of fineness of the powder can be regulated by regulating the quantity of the metal lumps put in the vessel.

To give a practical example of manufacturing lead powder according to the present invention;

A circular hollow cylinder made of iron, 60 inches in diameter and 60 inches in length, is horizontally and revolubly mounted. Within this cylinder is fitted an air-blower provided with small holes. Through one end of the cylinder is provided an orifice for feeding it with the material, and at the other end, an orifice to discharge the product.

The cylinder is, at the start, filled with 500 balls of steel, 1 inch in diameter, together with 1,000 kilograms of lead balls of 1.5 inches in diameter. As the abrasion is going on, the cylinder is replenished with lead ball continuously and at a definite speed at a rate of 100 kilograms an hour, while air blast having a pressure of 2.5 pounds per square inch, is sent out of the air-blower. The cylinder is caused to rotate at a rate of 15–25 times per minute. On account of this rotation of the cylinder, the lead balls contained therein get abraded and pulverized into very fine powder, which is blown out of the cylinder through the discharge orifice by means of the air blast from the said blower, and the lead powder thus blown out is led into a suitable chamber and collected there. By this operation, 100 kilograms per hour of fine powder with an apparent specific gravity of about 2.1 is obtained. The above described arrangement may be modified, and instead of providing a separate discharge passage, the cylinder body may be pierced through all over with small holes, whence the powdered product may be blown out to be collected in any suitable chamber.

The lead powder thus obtained is very fine and has an extensive surface so that its apparent specific gravity may be made, in some cases, even smaller than 1. It easily oxidizes and spontaneously ignites, so that it is necessary to provide with a cooling apparatus to radiate the heat generated by friction, when treating easily oxidizable metals, such as lead.

In short, the present invention does not crush, grind or file metals, but reduces them into powder by abrasion, pieces of the metal to be pulverized being put in a slowly rotating vessel, and caused to rub against one another and the wall of the vessel. The principal advantages of my invention over the hitherto known processes are as follows:—

1. A small amount of power is required; the process is simpler; and the fineness of the product can be regulated as desired.

2. A very high degree of fineness can be attained, without impairing the purity of the product.

3. The product being spongy and having

extensive surface, has a strong chemical reactivity. It often oxidizes in the air and spontaneously ignites. It is therefore most suitable for chemical purposes and is economical too.

4. The product oxidizes at a low temperature, but its catalytic action is very strong due to its extensive surface and consequently is very useful as a catalyzer, a depolarizer of electric battery, a reducing agent, or as an oxygen carrier.

Claims.

1. A method of forming a finely divided chemically reactive lead powder of such fineness and activity as to be readily changed chemically on contact with air, which comprises introducing relatively large masses of lead into a rotatable vessel, rotating said vessel at a relatively low speed and forming said lead powder by attrition of said lead masses resulting from the rubbing of said masses against each other.

2. A method of forming a finely divided chemically reactive lead powder of such fineness and activity as to be readily changed chemically on exposure to air, which comprises introducing relatively large masses of lead into a rotatable vessel, rotating said vessel at a relatively low speed, introducing a current of air into said vessel, forming said lead powder by attrition of said lead masses resulting from the rubbing of said lead masses against each other, and removing the said powder from said vessel by means of said current of air.

In testimony whereof I have affixed my signature.

GENZO SHIMADZU.

Patented May 11, 1926. 1,584,150

UNITED STATES PATENT OFFICE.

GENZO SHIMADZU, OF KYOTO, JAPAN

PROCESS OF MANUFACTURING POWDER OF LEAD SUBOXIDE INTERMINGLED WITH POWDER OF METALLIC LEAD.

No Drawing. Application filed July 14, 1923. Serial No. 651,821.

This application is a continuation in part of application Number 431,473, filed Dec. 17, 1920.

This invention relates to a process of manufacturing a very fine powder of lead suboxide intermingled with powder of metallic lead, consisting in putting pieces of metallic lead in a rotatable vessel, keeping the same at a temperature not less than 60° C., introducing into the vessel, while slowly rotating, air or any gas containing oxygen, or any other oxidizing agent, causing thus the surface of the pieces of metallic lead to oxidize lead-suboxide, and reducing the suboxide thus formed into a very fine powder by abrasion. The object of this invention is to obtain a large quantity of a very fine chemically reactive powder the principal part of which is lead suboxide, by promoting reduction of the metallic lead pieces into powder by abrasion by converting the surface of the pieces to suboxide.

This invention consists in putting in a rotatable vessel pieces of metallic lead, keeping these pieces at a temperature not less than 60° C., and while rotating the vessel sending air, or other gas containing oxygen thereinto, or sending any other oxidizing agent thereinto, thus oxidizing the surface of the pieces of lead and reducing them by abrasion into a very fine powder which is chemically very reactive.

In this invention the surface of the material, that is, metallic lead, is caused to be acted upon by the air or other oxidizing agent, and to be covered with a coating of lead-suboxide, which being brittle and lacking tenacity compared with metallic lead, can be easily and quickly reduced into powder by abrasion. And as soon as a new metallic surface of the pieces appears, it will be instantly oxidized and abraded, thus continuously producing the desired powder. Thus, the efficiency of manufacture is very great, and the product is a very fine oxidized powder of lead, which is chemically very reactive, intermingled only with a little coarse-grained powder.

The product of this invention is so fine that the apparent specific gravity is 1–3. The composition of powder is approximately from 93 to 97% lead suboxide and about 3 to 7% metallic lead. It is a porous mass of amorphous particles and although not very much different in its property from metallic lead, it is so chemically reactive that it is spontaneously converted into litharge by merely exposing it to air. If a drop of water is dropped on a pile of the same, or a lighted match is applied thereto, oxidation is started instantly, and by the reaction heat the oxidation continues until the whole is converted into litharge.

I am aware that there is known a process of manufacturing lead oxide by putting pieces of lead converted into monoxide or litharge in a rotatable drum, and excoriating the same. Another method known is to heat lead in a closed vessel to a point nearly approaching the melting point in presence of oxidizing agent and thus making lead oxide by heating. But these have nothing to do with the manufacture of lead suboxide, and it is evident that the object of these processes is quite different from that of the present invention, as lead suboxide resembles in its chemical and physical properties rather to metallic lead than to lead oxides; and I need not say that lead suboxide is quite different from other oxides of lead in brittleness, ductility &c., which are principal factors in reducing a substance into powder.

I will now give an example of putting my invention into practice.

Mount rotatably in a horizontal position an iron cylinder about 60 inches long with a diameter of about 60 inches pierced all over with holes 1/8 of an inch in diameter at a rate of four holes in one inch square, and put therein balls of metallic lead about one inch in diameter and also balls of steel or any other hard substance of about the same size. Provide the cylinder, or drum, with pipes to blow air thereinto. Now turn the cylinder at a rate of 25 times in one minute, blowing air thereinto all the while, and keeping the temperature within the cylinder at 60 to 200° C. Then the surface of lead balls will gradually be oxidized by the air, and they will be covered with a layer of lead suboxide, which is comparatively brittle and will be abraded into a fine powder. The metallic surface of the lead balls exposed by the rubbing off of the layer of lead suboxide formed thereon, will be acted upon by air and being oxidized a layer of lead suboxide will be again formed which will be abraded off again as before. Thus, by oxi-

dizing lead balls and abrading off the layer of lead suboxide thus formed, a fine powder can be very easily manufactured. The powder thus formed may be discharged from the holes on the wall of the cylinder.

In this invention, as an oxidizing agent, oxygen, hydrogen peroxide, ozone or a gas containing any of them, or anything that oxidizes the surface of metallic lead, may be utilized besides air. Any such oxidizing agent may be blown into the cylinder in a gust, or may cause the cylinder to suck it. If it is blown into, it is convenient to utilize the force of the current thus caused to blow the powder formed out of the cylinder, and then collect it.

Again, in this invention, in heating lead balls, friction heat or reaction heat caused by oxidation of lead, or both may be utilized; or heat may be introduced from an electric heater, gas heater, or any other source. The main point is to maintain the material lead in the atmosphere of air or any other oxidizing gas at a temperature of not less than 60° C. And in the case of utilizing friction or reaction heat that arises while working this invention, it is preferable to provide around the rotating cylinder heat insulating appliance to prevent the radiation thereof. Also it goes without saying that the production of heat in this case may be regulated by adjusting the weight of metallic balls, thus reducing or increasing friction surface and pressure, or by increasing or reducing the number of rotations of the cylinder.

The advantages of this invention may be enumerated as follows:—

(1) It is easy to maintain the harmony of oxidation of the surface of the material lead, and abrasion of oxidized lead; and a large amount of a fine powder of lead suboxide intermingled with powder of metallic lead, which does not practically differ in its properties from a fine powder of metallic lead, is obtained without using much powder.

(2) The rate of mixture of powder of metallic lead and that of lead suboxide, the apparent specific gravity, and condition of particles, of the product may be altered by adjusting temperature, gust of oxidizing agent, &c.

Claims:

1. A process of manufacturing a fine powder of lead suboxide intermingled with powder of metallic lead, comprising in putting pieces of metallic lead in a rotatable vessel in a dry state, introducing into the said vessel currents of an oxidizing gas to oxidize the surface of the lead while rotating the said vessel, and abrading off the oxide formed on the surface.

2. A process of manufacturing a fine powder of lead suboxide intermingled with powder of metallic lead, comprising in putting in a rotatable vessel pieces of metallic lead in a dry state, introducing into the said vessel while rotating blasts of a gas containing oxygen, such as air, causing such blast to blow the powder produced out of the vessel.

3. A process of manufacturing a fine powder of lead suboxide intermingled with powder of metallic lead comprising in putting pieces of metallic lead in a dry state into a rotatable vessel, and delivering an oxidizing gas into the vessel while revolving the same.

4. A process of manufacturing a fine powder of lead suboxide intermingled with powder of metallic lead, comprising in putting in a rotatable vessel pieces of metallic lead in a dry state, and rotating the vessel maintaining the temperature within the vessel at not less than 60° C., at the same time introducing into the vessel an oxidizing gas.

5. A process of manufacturing a fine powder of lead suboxide intermingled with powder of metallic lead, comprising in providing a rotatable vessel with a heat insulating means, putting in the vessel pieces of metallic lead in a dry state, and rotating the vessel maintaining the temperature of the lead at 60–200° C. and introducing into the vessel an oxidizing gas.

6. A process of manufacturing a fine powder of lead suboxide intermingled with powder of metallic lead, comprising in putting in a rotatable vessel pieces of metallic lead, introducing air thereinto and rotating the vessel maintaining the temperature of the material at not less than 60° C. by the heat generated by friction and chemical reaction.

7. A process of manufacturing a fine powder of lead suboxide intermingled with powder of metallic lead, comprising in putting in a rotatable vessel pieces of metallic lead and balls of steel, and rotating the vessel maintaining the temperature of the contents of the vessel at not less than 60° C., at the same time introducing air into the vessel, thus causing oxidation and abrasion to take place.

8. In the production of a finely divided mixture of lead suboxide and metallic lead, the step of tumbling together and agitating, a mass of hard heavy material containing metallic lead, while maintained at a temperature betweer about 60° C. and about 200° C.

9. A method of forming a finely divided powder containing a large proportion of oxidized lead which comprises impinging a current of air on lead masses in a dry state, abrading the lead masses, and controlling the temperature to obtain a finely divided powder containing a large proportion of oxidized lead.

10. A method of forming a finely divided



powder containing a large proportion of oxidized lead which comprises impinging a current of air on lead masses in a dry state, and controlling the temperature to maintain the temperature above 60 degrees C. to obtain a finely divided powder, containing a large proportion of oxidized lead.

11. A method of forming a finely divided powder containing a large proportion of oxidized lead which comprises impinging a current of air on lead masses in a dry state, abrading the lead masses, and controlling the current of air to obtain a finely divided powder, containing a large proportion of oxidized lead.

12. A method of forming a finely divided powder containing a large proportion of oxidized lead comprising impinging a current of air on lead masses in a dry state, abrading the lead masses, and controlling the temperature and current of air to obtain a finely divided powder containing a large proportion of oxidized lead.

13. A method of forming a finely divided powder containing a large proportion of oxidized lead which comprises impinging a current of air on lead masses in a dry state, and controlling the current of air and the temperature to maintain the temperature above 60 degrees C. to obtain a finely divided powder containing a large proportion of oxidized lead.

14. Comminuted lead-lead suboxide mixture with apparent specific gravity 1 to 3.

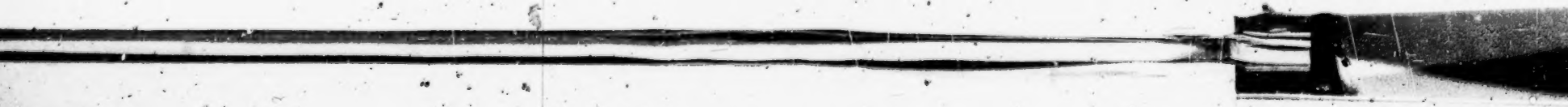
15. As a new composition of matter, a highly chemically reactive finely divided powder comprising a major portion of lead suboxide, said powder being capable of spontaneous oxidation.

16. As a new composition of matter, a highly chemically reactive powder, comprising a large portion of lead suboxide, said powder being capable of spontaneous reaction on contact with moisture.

17. As a new composition of matter, a highly chemically reactive powder, comprising a large portion of lead suboxide, said powder being capable of spontaneous reaction on contact with air.

In testimony whereof I have affixed my signature.

GENZO SHIMADZU.



Patented May 11, 1926. 1,584,151

UNITED STATES PATENT OFFICE.

GENZO SHIMADZU, OF KAMIKYO KU, KYOTO, JAPAN.

PROCESS OF MANUFACTURING LEAD OXIDE.

No Drawing. Application filed April 18, 1924. Serial No. 707,509.

This application is a continuation in part of application Number 431,473, filed December 17, 1920.

This invention relates to improvements in the process of manufacturing lead oxides and consists in oxidizing fine lead suboxide powder intermingled with metallic lead powder by the initial application of heat and without fusing the lead suboxide. The object of this invention is to simplify the process thereby economizing the labour and expenses of manufacture, and at the same time to obtain lead oxides, such as litharge, red lead or the like, in a pure state and in a special form, best adapted for the purposes for which they are generally used.

There are known various processes of manufacturing lead oxides by oxidizing fine powder of lead, but in all these known processes, lead powder must either be continuously heated or treated with steam, or an oxidizing a[illegible]t is used to accelerate the oxidation. Thus the work is troublesome, and the product is not pure.

Now, this invention removes all these drawbacks, and consists in taking pieces of metallic lead into a revolvable drum, and revolving the drum slowly at a rate of about twenty-five revolutions per minute, blowing the air into the drum all the while. Then the heat generated by friction and oxidation (within the drum) of the lead pieces will raise the temperature within the drum and maintain it at not less than 60° C. The friction too will form new metallic surface on the lead pieces, which as soon as formed will be converted into lead suboxide by the heat and the oxygen in the air. The film of lead suboxide thus formed will be reduced to powder by abrasion, but not by lead pieces striking against one another, like in the case of a common tube mill or ball mill. When the lead suboxide film is abraded off, a new metallic surface will be formed, which as soon as formed will be abraded off as before, thus continually producing fine powder of lead suboxide intermingled with metallic lead powder directly and in dry condition. The lead suboxide powder intermingled with metallic lead powder thus obtained is so fine and chemically active that if a lighted match be applied to part of its pile or a few drops of water be dropped on it, oxidation will instantly commence, igniting it briskly as if it were burning sulphur or such easily inflammable substance. Thus, if care be taken that the material does not fuse, the whole of it shall be instantly converted into powder of lead monoxide without supplying any more external heating or using any oxidizing agent other than air. And if fresh supply of lead suboxide powder be piled upon small remainder of the actually oxidizing lead suboxide powder, the ignition may be perpetually maintained.

The lead suboxide powder intermingled with metallic lead powder produced according to this invention is extremely fine, porous and spongy, its apparent specific gravity being not more than 1–3. It is chemically very active, sometimes starting spontaneous ignition in the air. If it comes into contact with water or moisture, it generates a great heat, and instantly turns into lead monoxide, lead hyroxide, basic lead hydroxide, or the like; and as it becomes red-hot by the reaction heat rising, it becomes chemically very reactive. It is very reactive, but is not unstable like lead suboxide powder manufactured chemically by reducing lead oxalate, and is therefore very convenient to handle industrially as a material.

Sometimes lead suboxide intermingled with a small proportion of metallic lead powder, may be left exposed to the atmosphere from two to four weeks, and the powder will be converted into litharge, being oxidized directly by the oxygen in the air.

The litharge thus obtained can be turned into red lead, as is commonly practiced, by heating the same in a furnace, or a pan at a temperature not more than 500° C.

Thus this process is economical, because heat is necessary only to start oxidation at a part of the material, and the reaction heat does the work of oxidizing the rest. It is very simple and saves much labour. Also, as it is simple there is little chance of impurities getting into the product. If we select pure lead pieces for material, we shall be able to obtain pure powder not containing any other metal, from which we can manufacture litharge and red lead purer than those now on the market. Moreover, the product obtained by my process has different properties from lead oxides obtained by known processes, that is, by continuous heating or the use of a chemical agent to accelerate oxidation. It is more porous and lighter in the apparent specific gravity, such properties depending upon fineness of the lead suboxide powder which can be regu-

lated at will. Thus, the litharge or red lead manufactured according to my process is an ideal material as the paste for lead accumulators on account of its purity and the properties mentioned above. Used as paint, it has a higher consistency and extensibility and is rich in covering power.

I claim:

1. The process of forming finely divided oxygenated lead compounds which comprises treating a finely divided chemically reactive powder comprising a major portion of lead suboxide with an oxidizing substance.

2. The process of forming a finely divided oxygenated lead compound which comprises treating a finely divided chemically reactive powder comprising a major portion of lead suboxide with an oxidizing substance, and maintaining the reaction by the evolved heat of reaction.

3. The process of forming a finely divided oxygenated lead compound which comprises treating a finely divided chemically reactive powder comprising a major portion of lead suboxide with an oxygen containing substance and continuing the reaction by the evolved heat of reaction.

4. The method of forming finely divided lead oxide which comprises treating a finely divided chemically reactive powder comprising a large proportion of lead suboxide and a minor proportion of metallic lead with air, and continuing the reaction by the evolved heat of oxidation.

5. The method of forming a finely divided oxygenated lead compound which comprises contacting finely divided chemically reactive powder comprising a large proportion of lead suboxide with moisture and continuing the reaction by the evolved heat of reaction.

6. The process of forming higher oxides of lead which comprises treating a finely divided chemically reactive powder comprising a major portion of lead suboxide with an oxidizing substance to form lead monoxide, and oxidizing said lead monoxide to such higher oxides of lead.

7. The process of forming higher oxides of lead which comprises treating a finely divided chemically reactive powder comprising a major portion of lead suboxide with an oxidizing substance, maintaining the reaction by the evolved heat of reaction to form lead monoxide and oxidizing said monoxide to said higher oxides of lead.

In testimony whereof I have affixed my signature.

GENZO SHIMADZU.

Patented May 11, 1926. 1,584,152

UNITED STATES PATENT OFFICE.

GENZO SHIMADZU, OF KAMIKYO KU, K.OTO, JAPAN.

PAINT.

No Drawing. Application filed April 18, 1924. Serial No. 707,510.

This case is a continuation in part of application Number 532,725, filed January 30, 1922, and a continuation in part of application Number 431,473, filed December 17, 1920.

This invention relates to a paint, consisting of lead suboxide powder intermingled with powder of metallic lead of a very small apparent specific gravity combined with boiled oil, or a mixture of boiled oil and resin, or any other vehicle generally used in paints, and the object thereof is to obtain a paint having a great covering capacity and extensibility, at the same time acting as an anti-corrosive as well as anti-fouling paint, the chemically reactive force of lead suboxide powder being utilized for the latter purposes.

The lead suboxide powder used in this invention is obtained in dried condition by abrading mechanically successive films formed on lead pieces exposed to the air and kept at a temperature not less than 60° C. The lead suboxide powder intermingled with metallic lead powder thus obtained has special properties different from those of lead suboxide hitherto known, and is spongy and porous, having an apparent specific gravity of 1–3. Exposed to water or moisture, it is instantly converted into lead monoxide, lead hydroxide or basic lead hydroxide. It is so chemically reactive that if a few drops of water be dropped on a pile of it, or a lighted match be applied thereto, it ignites as if it were sulphur or such easily inflammable substance, until the whole of the pile is converted into litharge. The lead suboxide powder intermingled with metallic powder used in this invention is thus chemically very active but is not unstable as such powder manufactured chemically by reducing lead oxalate, and is very convenient to handle and preserve for industrial purposes. It is of such special qualities, and used in the place of red lead, it proves not only to be a very efficient pigment, but is also anti-corrosive and anti-fouling on account of its reducible and poisoning properties.

To show an example of carrying my invention into practice, round pieces of lead are put in a revolvable drum together with steel balls, and the drum is slowly revolved, introducing thereinto air or any other oxidizing gas. Then the heat generated by friction and oxidation of the lead pieces will keep the interior of the drum at a temperature not less than 60° C., and films of lead suboxide will be formed on the face of the lead pieces. The films of lead suboxide successively formed on the lead pieces are successively abraded off, and a very fine and chemically reactive lead suboxide powder intermingled with a small proportion of powder of metallic lead is produced. Such powder is then mixed with boiled oil, varnish vehicle, solution of casein, cellulose esters, lacquers, or any other vehicle of paints, and is kneaded; and a paint of a suitable consistency will be obtained. When the paint of my invention is spread over the surface of iron or any other metal, or wood, and exposed to the air, it gets gradually oxidized in a natural way as the vehicles dries, forming finally a compact layer of oxide just like one formed spontaneously on the polished surface of a metal, and serves as a very efficient protective film. The surplus lead suboxide and metallic lead act as a strong poison against living organisms, such as shell fish, worms, insects, sea-weeds, and bacteria, and serves to prevent their attachment.

The paint of my invention possesses, moreover, a covering capacity and an extensibility several times greater than ordinary red lead paint. It makes, therefore, a very efficient and convenient anti-corrosive and anti-septic paint, it being especially efficient and economical for painting the ship's bottom, because with my paint one need not go through the trouble of giving to the ship first an anti-corrosive coating, and then when it has dried, a second coating of anti-fouling paint, but only one coating efficiently attains the two objects.

The inventor is aware that powder of lead suboxide, or metallic lead, is used as a material of paints, but the lead suboxide powder intermingled with metallic lead, used in this invention has characteristics quite different from those of hitherto known lead suboxide, or metallic lead, powder, and by using the powder having such special characteristics, the inventor has been enabled to secure special efficiency. It is firmly believed that this application therefore constitutes a new invention.

Claims.

1. A paint comprising a vehicle and a finely divided chemically reactive powder containing a major proportion of lead sub-

oxide and a minor proportion of metallic lead, said powder resulting from the impingement of a current of air on relatively large masses of lead in a dry state, subjecting the lead to surface attrition, controlling the temperature to cause the formation of lead suboxide in the said proportions, and carrying of the powder resulting from the above by the said current of air.

2. A paint comprising a vehicle and a finely divided chemically reactive powder containing a major proportion of lead suboxide and a minor proportion of metallic lead, said powder resulting from the impingement of a current of air on relatively large masses of lead in a dry state, subjecting the lead to surface attrition, controlling the temperature to be not less than sixty degrees centigrade, so as to form powder containing lead suboxide in the above proportions and carrying of the powder so formed by the above mentioned current of air.

In testimony whereof I have affixed my signature.

GENZO SHIMADZU.

Patented May 11, 1926. 1,584,479

UNITED STATES PATENT OFFICE.

GENZO SHIMADZU, OF KYOTO, JAPAN.

PROCESS OF MAKING PLATES FOR STORAGE BATTERIES USING LEAD SUBOXIDE.

No Drawing. Application filed February 20, 1923. Serial No. 620,267.

This invention relates to a process of manufacturing plates for storage batteries characterized by using as the principal active material lead suboxide (Pb_2O), mixing the same with water or dilute sulphuric acid, kneading the mixture and coating or filling in the plates or grids with the paste thus formed. The object of this invention is to obtain durable plates for storage batteries by causing the lead suboxide to convert easily to hydroxide while drying.

Plates for storage batteries, according to methods hitherto known, are generally manufactured by coating or filling in the plates or grids with a paste formed by kneading a lead oxide, such as litharge minium, together with dilute sulphuric acid, but in such method, the chemical change that occurs in the lead oxide, and the drying of the paste must be so regulated that they progress parallel. Otherwise, the paste, losing its volume by drying, will crack, and interspaces will be formed between the coating and the plate or grid, thus shortening the life of the battery. Moreover, when drying the paste, as it does not undergo any structural change, as hardening of cement by hydration, it is very difficult to make batteries that last long.

According to this invention, a very fine and spongy lead suboxide of an apparent specific gravity of not more than 3 is utilized as active material, and is applied to the plate, or grid, after kneading the same in water or dilute sulphuric acid, into a paste. After application to the plate or grid and when drying, such paste will be acted upon by water and oxygen in the air, and will be converted into lead hydroxide and will increase its volume which, counteracting the shrinkage due to drying, removes the drawback of cracking. Moreover, when the suboxide is converted into hydroxide, a marked change in the construction of the paste takes place and the paste hardens in the same condition as cement hardens by hydration, and thus very durable batteries can be manufactured.

The lead suboxide used in this invention, is formed by reducing metallic lead into fine, spongy powder by mechanical abrasion. It is chiefly composed of lead suboxide, but is sometimes intermingled, from the nature of the process to manufacture it with 1 to 40% metallic lead powder. Also, from the nature of lead suboxide, it is slowly converted, while being manufactured or when it is left exposed to the air, into monoxide, and consequently it is sometimes intermingled with lead monoxide. But such lead monoxide formed by oxidation in a warm room in the atmosphere retains, different from monoxide formed by igniting lead powder, an apparent specific gravity of the suboxide used as the material, easily hardens, is rich in activity and forms a durable plate. Consequently, even when lead suboxide is slowly oxidized while it is stored, such oxide in no way obstructs the carrying of this invention into effect.

Thus, in my invention, the lead suboxide used as material, is manufactured without using any water; there is little chance for any impurities to intermingle therewith during the process of manufacture; and there is no necessity of adding to the lead suboxide when kneading the same into paste in order to lengthen the life thereof any drug prejudicial to batteries. Moreover, the process of "forming" may be entirely dispensed with, plates being "formed" when the battery is charged with electricity for the first time. Of course, the process of "forming" may be carried out according to the ordinary method.

To explain my invention more in detail, the following is an example of carrying it into practice:—

Pieces of metallic lead are reduced to fine powder by causing the pieces to rub against one another in a slowly revolved drum, and the powder is then exposed to the air. Then take 300 grammes of such powder, which is very fine and light, having an apparent specific gravity of not more than 3, mix it with 45 cubic centimeters of water, knead the mixture and with the paste thus formed coat or fill the ordinary plates or grids. When the plates are dry, they are ready to be used for storage batteries. Apparent specific gravity is measured by filling a vessel of known capacity with lead suboxide powder by causing the powder to fall from a sieve, smooth the surface softly without pressing, and weigh it. Then, take weight of water of 4° C. of the same volume,

and divide the weight of the former by that of the latter, and the quotient is the apparent specific gravity sought.

Claims:

1. The process of preparing plates for storage batteries, which consists in reducing metallic lead to a fine powder, exposing said powder to the air, mixing the same with liquid, kneading the mixture into the form of a paste, coating the plates with said paste, and drying the same thereby to convert the lead suboxide into lead monoxide and lead hydroxide.

2. The proces of preparing plates for storage batteries, which consists in reducing metallic lead to a fine powder, exposing the same to the air, mixing 300 grammes of said powder with 45 cubic centimeters of water, kneading the mixture to form a paste, coating the plates with said paste, and drying the same thereby to convert the lead suboxide into lead monoxide and lead hydroxide.

3. A process of manufacturing plates for storage batteries, consisting in kneading lead suboxide intermingled with lead monoxide and sufficient liquid to form a paste and applying the same to or filling therewith the plates or grids.

4. A process of manufacturing plates for storage batteries, consisting in kneading lead suboxide intermingled with lead monoxide, metallic lead, and sufficient liquid to form a paste, and applying the same to or filling therewith the plates or grids.

In testimony whereof I have signed my name to this specification.

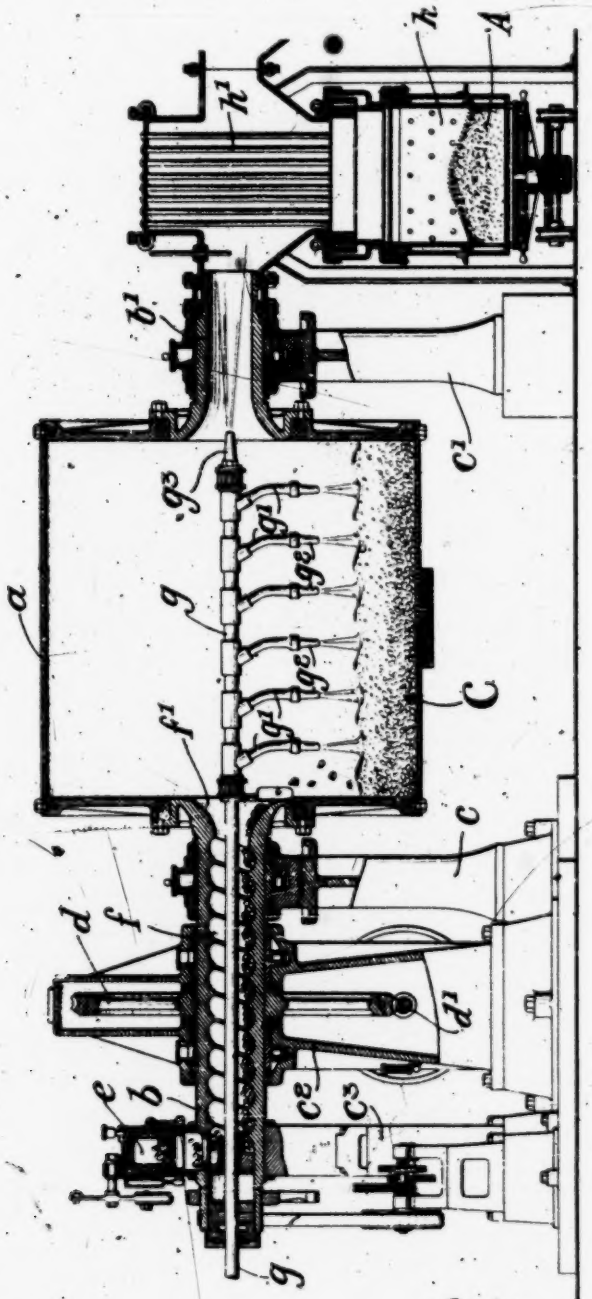
GENZO SHIMADZU.

Jan. 31, 1933. G. SHIMADZU 1,896,020

APPARATUS FOR THE CONTINUOUS PRODUCTION OF LEAD OXIDES IN THE DRY STATE

Original Filed April 27, 1926 2 Sheets-Sheet 1

Fig. 1.



G. Shimadzu
Inventor

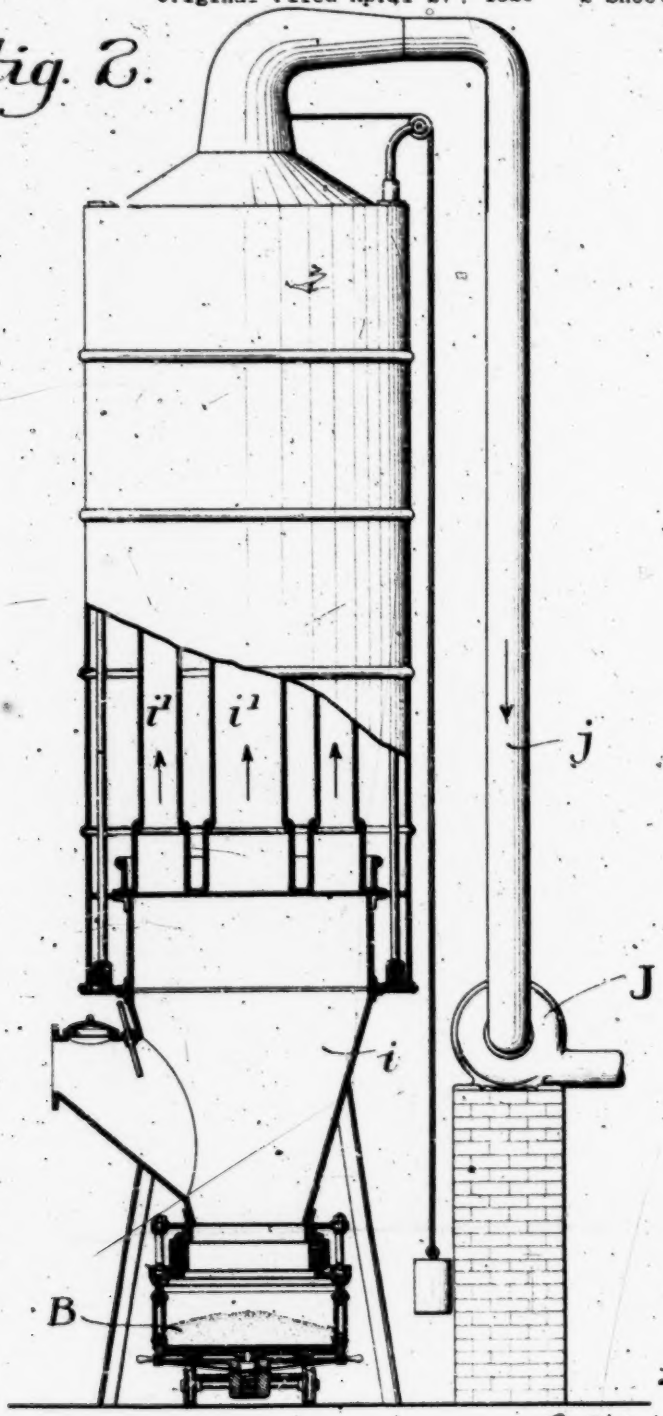
By Marks & Clerk
Attys

Jan. 31, 1933. G. SHIMADZU 1,896,020

APPARATUS FOR THE CONTINUOUS PRODUCTION OF LEAD OXIDES IN THE DRY STATE

Original Filed April 27, 1926 2 Sheets-Sheet 2

Fig. 2.



G. Shimadzu inventor

By: Marks & Clark Attys

Patented Jan. 31, 1933 1,896,020

UNITED STATES PATENT OFFICE

GENZO SHIMADZU, OF KIOTO, JAPAN

APPARATUS FOR THE CONTINUOUS PRODUCTION OF LEAD OXIDES IN THE DRY STATE

Application filed April 27, 1926, Serial No. 104,998. Renewed June 21, 1929.

This invention relates to an apparatus for the continuous production of lead oxides, the object of the invention being to obtain such oxides in the form of extremely fine powders and in a dry state.

The invention involves the subjection of pieces of metallic lead maintained in a state of agitation to artificially supplied atmospheric air or other oxidizing gas whereby a film or coating of oxide will be formed on the pieces, the formation of the film or coating being augmented without fusion of the metal by the heat generated in the principal reaction between metallic lead and the oxidizing gas and by the frictional heat created through rubbing of the pieces one against the other, this rubbing action causing also a brading off as a fine powder of the oxide thus produced and the oxidizing gas or a part thereof being also utilized to carry off the powder for collection and further treatment if needs be.

Broadly the apparatus of the invention comprises a vessel adapted to be rotated, means for feeding pieces of metallic lead thereto while the vessel is rotating, and means for artificially supplying atmospheric air or other oxidizing gas to the interior of the vessel in such a manner as to contact with the surfaces of the pieces of lead to oxidize the same and to take up and convey the formed oxide powder as it is abraded by the rubbing action of the pieces against each other to a collector and/or filter device.

In the appended drawings, I have shown an advantageous form of apparatus in which Figure 1 (horizontal section) represents an oxidizing chamber and Figure 2 (elevation with parts broken away), a dust catching tower.

Referring more particularly to Figure 1 of the drawings, *a* denotes a drum which for the purpose of permitting rotation is provided with trunnions *b*, *b'* supported by bearings *c*, *c'*. The trunnion *b* is also journalled in a bearing c^2 which is so designed as to form a casing for a worm-wheel *d* fast on the trunnion *b*, said worm-wheel being in mesh with a worm *d'* coupled to a suitable source of power.

The trunnion *b* is hollow and its interior is provided with helical grooves *f* which as the trunnion rotates function as a screw conveyor *f* which is supplied with pieces of lead by an automatic feeder *e*. Trunnion *f* conveys the pieces C' to the drum *a* into which they fall at *f'*.

Arranged axially in the hollow trunnion *b* is a stationary pipe *g* which extends into the drum *a* and is provided with downwardly directed branch pipes *g'* which may be provided at their ends, with nozzles g^2. The pipe *g* serves to supply atmospheric air or other oxidizing gas under relatively high pressure from a suitable source to the interior of the drum whilst the latter is rotating. The air or gas issuing from the nozzles g^2 impinges upon the lead pieces in the drum and acts primarily to cause a coating or film of oxide to be formed thereon. The trunnion *b'* is also hollow and the inner end of the supply pipe *g* is provided with a nozzle g^3 so arranged with respect to the interior of the trunnion *b'* as to form an ejector or exhauster for the drum *a*.

The oxide which in fact is a sub-oxide is formed on the pieces principally by the action of the oxidizing gas thereon as has been explained, the gas acting continuously on the surface of the pieces which are maintained in a state of agitation owing to the rotation of the drum so that all the pieces are properly subjected to the oxidizing action. This oxidation is aided by the heat generated by the reaction itself and also by the friction set up owing to the rubbing of the pieces one against the other. The oxide film or coating is of a comparatively brittle nature and the continual rubbing of the pieces together due to the rotational motion of the drum *a* causes this film or coating to be abraded off as a suboxide powder, thus exposing fresh surfaces of metallic lead to the action of the oxidizing gas and the other conditions which augment the formation of the oxide film. This abrading off or removal of the suboxide coating from the pieces of metallic lead is also caused in part by the impinging of the air from jets g^2 on the surfaces of the pieces of metallic lead. The air which is fed through pipe

g to the nozzles g^2 at relatively high pressure leaves the nozzles at a velocity sufficiently high to blow any oxide from those pieces of lead on which the air impinges. The combined rubbing action of the pieces and action of the jets of air upon the pieces of metallic lead provides a very efficacious means of reducing the oxide to a remarkably fine powder, so fine in fact that from tests made it has been proved that the weight of a given volume of the powder is only from one third to one tenth of the weight of the same volume of metallic lead, or less of the weight of the same volume of water. As a further proof of its fineness it is found that the sub-oxide powder will readily convert to litharge in the presence of an oxidizing agent by spontaneous oxidation after the application of initial heat. That is to say, if the heat of a match for example be applied momentarily to a quantity of the powder, the combustion will proceed of its own accord until all the powder has been converted to litharge.

The suboxide which is formed in my machine in the above described manner is a very unstable fine powder. It is essential that it be removed from the mill in which it is formed immediately after it has been ground or blown from the lumps of lead. Otherwise if it is permitted to remain within the mill for any appreciable length of time it will go over to litharge inasmuch as the temperature within the mill is sufficiently high and there is a plentiful supply of air present. In the arrangement shown the powder is removed substantially instantaneously after formation by the currents of air issuing from jets g^2 which penetrate the entire mass of lead and which leave the mill through trunnion b' carrying with it the formed powder. As will be noted the interior of trunnion b is flared from the drum to form a nozzle which, combined with the action of the air issuing from jet g^2, functions as an ejector to aid in the rapid removal of said powder. A chamber h is connected near its upper end to the hollow trunnion b' and acts to collect the powdered oxide or a portion of it issuing from the trunnion. This chamber h is provided with a plurality of vertical bars h' which act as a screen or sieve to break down the conveying action of the ejector by impingement of the particles thereagainst so that the particles will fall into the bottom of the chamber and accumulate therein as indicated at A. The sub-oxide powder may be removed as such from the chamber h at convenient intervals.

Frequently it is desirable that the product be in the form of litharge rather than suboxide. With the construction shown, the suboxide powder may be readily converted to litharge before removal from the container h. The advantage of converting the powder to litharge in this manner is that the conversion will be complete and the product will be uniform throughout due to the fact that the air within the chamber h is in heated condition and while so heated it has ready access to the powder as it falls on the pile a. Were the suboxide powder first permitted to accumulate in a pile and then oxidized it would be found that the product would not be uniform but that a large portion on the inside of the pile to which the air does not have ready access would remain in the suboxide state. To start the oxidation it is necessary to apply external heat to the product but once started the heat generated by the reaction will be sufficient to oxidize all of the powder which is thereafter formed in the mill and delivered to the chamber h. Any powder intermingled with gas that passes through the screen h' is transferred to a bag room or filter tower i where it is finally separated from the gas. This tower is provided with filter bags of suitable material such as silk which are subjected externally to a rarefied atmosphere or vacuum created in the upper part of the tower by means of the exhauster J. By this means the gas is drawn through the bags leaving the powder on the interior surface thereof from whence it falls and is collected at the bottom of the tower as indicated at B. Here again the sub-oxide powder may be removed as such at convenient intervals or first converted into litharge.

It will be appreciated that if found desirable a plurality of filter towers may be provided in series whereby the extracted gas may be subjected to further filtration to ensure complete separation of powder. It will also be appreciated that the provision of an initial separator h followed by a filter or filters is not essential to the carrying out of the invention. In some cases it might be found that the separator h could be dispensed with in which case the filter stage could be coupled direct to the drum. Again, the separator might in some instances be used without a filtration stage. I reserve to myself the right to such modification and others that are obvious in the construction and assembly of the apparatus.

I claim:

1. Apparatus for the production of lead oxides in the dry state, comprising a vessel adapted to be rotated, hollow trunnions supporting said vessel, a screw conveyer disposed in one of said hollow trunnions to introduce material into said vessel, an air pipe passing through said hollow trunnions and terminating in the other of said hollow trunnions whereby air passing through said pipe acts to expel dry material from said vessel through said other hollow trunnion.

2. Apparatus for the production of lead oxides in the dry state, comprising a vessel adapted to be rotated, hollow trunnions supporting said vessel, a screw conveyer dis-

posed in one of said hollow trunnions to introduce material into said vessel, an air pipe passing through said hollow trunnions and terminating in the other of said hollow trunnions whereby air passing through said pipe acts to expel dry material from said vessel through said other hollow trunnion; said air pipe having branches thereon provided with nozzles whereby air is also introduced into the interior of the drum.

3. Apparatus for the continuous production of lead oxides in the dry state, comprising a vessel adapted to be rotated, means for supplying oxidizing gas to the interior of the vessel, an outlet for said gas, and means comprising an injector for increasing the velocity of said gas as it passes through said outlet.

4. Apparatus for the continuous production of lead oxides in the dry state, comprising a vessel adapted to be rotated, means for feeding lumps of metallic lead to said vessel, a pipe for feeding air under pressure to said vessel a plurality of jets extending from said pipe to impinge upon said metallic lead pieces within said vessel whereby the surfaces thereof are oxidized, means for rotating said vessel to abrade said oxide from said surfaces by mutual attrition, and means for removing said oxide from said vessel substantially instantaneously upon formation.

5. Apparatus for the continuous production of lead oxides in the dry state, comprising a vessel adapted to contain pieces of metallic lead, means for feeding lead to said vessel, a pipe for feeding air under pressure to said vessel, a plurality of jets extending from said pipe to impinge upon the surfaces of said metallic lead pieces within said vessel, whereby the surfaces of said lead pieces are oxidized, means for rotating said vessel to cause said oxide to be abraded from said pieces by mutual attrition, said vessel having an outlet and means at the end of said pipe extending into said outlet for causing said air to pass through said outlet at a sufficiently high velocity to carry said abraded oxide from said vessel.

6. Apparatus for the continuous production of lead oxides in the dry state, comprising a vessel adapted to be rotated, means for feeding pieces of metallic lead to said vessel, a pipe for feeding air under pressure to said vessel a plurality of jets extending from said pipe to impinge against the surfaces of said lead pieces whereby said surfaces are oxidized and said oxide is blown from said pieces, and an ejector for removing said gas and said oxide from said vessel.

7. Apparatus for the continuous production of lead oxides in the dry state comprising a drum, means for feeding pieces of metallic lead to said drum, a conduit extending into said drum and connected to said source of supply of air under pressure, a plurality of nozzles connected to said conduit for causing said air to impinge upon said metallic lead pieces within said vessel whereby the surfaces of said pieces are oxidized, means for rotating said drum to grind said oxide from said metallic lead pieces, an ejector for removing said air and said oxide from said drum, means interposed in the path of travel of said air and powder for separating a portion of said powder from said air, and a collector for removing the remainder of said powder from said air.

8. Apparatus for the continuous production of lead oxides in the dry state comprising a drum, a conduit connected to a source of supply of air under pressure and extending into said drum, a plurality of nozzles connected to said conduit for causing said air to impinge upon said metallic lead pieces within said drum, means for rotating said drum, an outlet for said drum, an ejector for blowing said product from said drum through said outlet and a collector connected to said last named means for supplying said product from said air.

9. Apparatus for the continuous production of a product including litharge in a dry state comprising a vessel rotatable on axes and means extending through an axis for feeding pieces of metallic lead to said vessel, a conduit for feeding an oxidizing gas under pressure to the lower part of said rotatable vessel, said vessel having an outlet above the zone of impact between the oxidizing gas and the lead pieces in the vessel, whereby said oxidizing gas oxidizes the surface of the lead pieces and then blows the powdered lead oxides upwardly and outwardly from said surfaces, means for rotating said vessel, a chamber having a conduit communicating with said rotatable vessel, said chamber having vertically extending fabric filters in its upper portion and a lower portion below said filters into which said oxides may slide off and fall from the filters to be further oxidized to litharge and a conduit from the filters to conduct away the oxidizing gas separated by the filters from said oxides.

10. Apparatus for the continuous production of a product including litharge in a dry state comprising an apparatus including a vessel in the form of a drum, means for feeding pieces of lead into the drum, means for rotating the drum to cause frictional movement between said pieces, means for supplying under pressure an oxidizing gas to the interior of the drum so as to act on said pieces to form a coating of lead suboxide thereon and to remove from the pieces the powder formed by the abrading action of the pieces against one another, and means associated with said apparatus in which said lead suboxide may be converted into litharge while still in its dry state.

11. Apparatus for the continuous produc-

tion of litharge in a dry state comprising an apparatus including a vessel in the form of a drum, means for feeding pieces of lead into the drum, means for rotating the drum to cause frictional movement between said pieces, means for supplying under pressure atmospheric air to the interior of the drum in suchawise as to act on said pieces to form a coating of lead suboxide thereon and to take up and remove from the pieces the powder formed by the abrading action of the pieces against one another, and means associated with said apparatus whereby said lead suboxide is converted into litharge, and means for receiving the product collected from said apparatus

In testimony whereof I have affixed my signature.

GENZO SHIMADZU.

PLAINTIFFS' EXHIBIT NO. 61.

Patent No. 60825 (Public Notice No. 52079)
Classification No. 144 (6) oxidized products.
Date of Application—February 3, 1923.
Public Announcement—August 15, 1923.
Patent Issued—June 19, 1924.
Patent Owner (Inventor)
Genzo Shimiazu
420 Todoin goike Noboru Funaya Street
Jokyo ku, Kyoto.
His representative (attorney)
Morio Nakamatzu and two others.

DETAILED DESCRIPTION

Method of Manufacturing Lead Suboxide Powder Containing Metallic Lead

Character of the Invention and Gist of its Object

This invention is an improvement over Patent No. 41728 and consists of a method of manufacturing a fine powder of lead suboxide containing metallic lead by putting lumps of metallic lead or a coarse powder inside a rotating vessel, and while maintaining the temperature of the metallic lead above 60° Centigrade slowly rotating and grinding it to powder by the rubbing. Its purpose is the acceleration of the oxidation of metallic lead by a rise in temperature to form a layer of lead suboxide on the surface, and consequently augment the rubbing action and increase the manufacturing efficiency of fine powder.

Detailed Explanation of the Invention

Although when metallic lead is exposed to air, the surface is gradually spontaneously oxidized, the rate of oxidation is very slow. But as the temperature is raised the rate of oxidation is conspicuously increased. According to

experiment when the temperature reaches 60° Centigrade the phenomenon of oxidation is apparent and at approximately 160 degrees centigrade the surface already presents the appearance of lead suboxide. This invention utilizes this fact and is an improvement over the original Patent No. 41728. It provides for the manufacture of fine powder of lead suboxide containing metallic lead powder by placing lumps of metallic lead or coarse powder inside a rotating vessel maintaining said metallic lead at a temperature above 60° C. in an atmosphere of air or other oxidizing gases, rotating the vessel, causing lead suboxide to form on the surface of the metallic lead and alternately grinding and removing this as it forms.

In this invention the heat of friction, or the heat of reaction due to oxidation of the lead or both are used to increase the temperature of the metallic lead, and there is no bother in supplying external heat such as can be induced from electric heaters, gas heaters or other sources of heat. It is only required that the raw material of metallic lead be kept above a temperature of 60° centigrade in an atmosphere of air or other oxidizing gas. But in case heat produced by the process of this invention, like heat of friction and heat of reaction, are used, some device for maintaining the temperature had better be made to prevent dissipation of the heat resulting from conduction and radiation. Moreover, at this time, of course, by adjusting the rubbing surfaces and pressure by the number of metallic balls, and regulating the rate of revolution of the vessel, the amount of heat can be controlled.

In this invention the maintained temperature of the raw metallic lead material accelerates the oxidizing action so that a coating of lead suboxide is quickly found on the surface, and said layer of lead suboxide is readily ground to the state of a fine powder. The surface of newly exposed metallic lead is then changed to lead suboxide and as a result of alternately, or successively grinding and removing, not only is a great deal more of the product formed than by the invention of the original patent, but the follow-

ing results can be listed: (1) Since oxidation of the surface of the raw lead material is maintained in accord with the grinding action, there is little waste of power and the manufacturing efficiency can be very greatly increased. (2) By regulating the temperature the proportion of lead suboxide powder and metallic lead powder changes, so the observed specific gravity of the product and the condition of the particles can be changed as one desires. (3) Finely powdered lead suboxide containing finely powdered metallic lead like the product of this invention is chemically very reactive in comparison with pure metallic lead powder or lead suboxide; when the material is further oxidized in this way forming lead peroxide or litharge and it is supplied as the paste material for electrodes of storage batteries, the results are very good.

One example of its practical application will now be pointed out.

Four small holes about ⅛ inch in diameter are bored in every square inch of surface through the curved walls of a cylindrical iron vessel of diameter about 60 inches and length about 60 inches and whose outer wall is made of asbestos coating or other heat insulating material and so constructed that it can be rotated. Two hundred fifty kwans of metallic lead balls approximately 1 inch in diameter are thrown in, and the vessel rotated at about 25 revolutions per minute while air or other oxidizing gases are made to circulate within the vessel. When the temperature of the metallic lead within the vessel is maintained at 60 degrees C. or above, the surface of the metallic lead is readily oxidized and a coating of lead suboxide formed, said lead suboxide coating being ground off and removed by the frictional rubbing of the metallic lead balls on one another and frictional rubbing of the metallic lead balls on the inner walls of the vessel. The newly exposed metallic lead surface is then oxidized and successively and continuously a fine powder can be formed.

In this invention hard balls, like steel balls, can be thrown inside the rotating vessel with the metallic lead ma-

terial and assist in the frictional rubbing, and a blast of air or other oxidizing gas can be forced into the rotating vessel or these currents of gas can be set up by means of suction.

Mutual Relation of the Inventions

This invention is an improvement of the original patent No. 41728 and strikes at the practical application. The case of using small holes bored in the curved walls of a rotating vessel was included and used in patent of addition No. 42562. Moreover, the throwing of steel balls or other steel-like balls into a rotating vessel with the metallic lead was used in patent of addition No. 42564. Presumably as compared with these patented inventions the present invention accelerates the grinding action and very greatly increases the manufacturing efficiency of the product by especially maintaining the metallic lead material at the proper temperature during the formation of lead suboxide.

Scope of Patent Claim

In order to achieve the object recorded above, a method of manufacturing lead suboxide powder containing metallic lead powder is claimed, a special feature of which is putting lumps of lead or coarse powder in a rotating vessel, and rotating the vessel while maintaining the lead above 60 degrees centigrade in an atmosphere or air or other oxidizing gases.

Additional Claims:—

(1) In order to achieve the purpose of the above record, a method of manufacturing lead suboxide powder containing metallic lead is claimed, in which a constant temperature arrangement is set up in a rotating vessel or container, lumps of lead or coarse powder are thrown into it and the vessel rotated while the temperature of the metallic lead is maintained above 60 degrees centigrade.

(2) In order to achieve the purpose listed above, a method of manufacturing lead oxide powder containing metallic lead is claimed, by throwing lumps of metallic lead

or coarse powder into a rotating vessel and rotating the vessel while maintaining the metallic lead material at a temperature of or above 60 degrees centigrade in an atmosphere of air or other oxidizing gas by means of the heat of friction or the heat of chemical reaction, or both.

(3) In order to achieve the object recorded above a method of manufacturing lead suboxide powder containing metallic lead is claimed as described under scope of patent claims No. 1 in which metallic lead is thrown inside a rotating vessel and a definite temperature maintained inside the vessel by supplying electrical heat, gas heat or some other suitable source of heat.

(4) In order to achieve the object of the above record a method of manufacturing lead suboxide powder containing metallic lead is claimed as described under Scope of Patent Claims No. 1, in which lumps of metallic lead or coarse powder are placed inside a rotating vessel, this is kept at a temperature above 60 degrees centigrade and the vessel rotated while air is passed through it.

DEFENDANT'S EXHIBIT NO. 78.

7-24-17

LEAD DUST MANUFACTURE
ANALYSIS OF RESULTS OF EXPERIMENTS

PRODUCT
- (A) Rate produced
  - Directly
    - (D) Revolutions per minute
    - (E) Hardness of lead
  - Indirectly
    - (F) Load in drum
    - (G) Room Temp. & Ventilation
- (B) Oxidation
  - Directly:—(E)—Hardness of lead
  - Indirectly
    - (H) Temp. of & ventilation thru machine
    - (I) Time in machine
    - (J) Mesh of screen
    - (K) Length & angle of delivery tube
- (C) Apparent Sp. Gr.
  - Directly:—(B) Oxidation
  - Indirectly:—(L) Fineness of material
    - (E) Hardness of lead
    - (D) Rev. per min.

NOTE:—"Directly" as used above indicates that, other factors remaining constant, the property (P) of the product is a direct simple function of the factor (X) i. e. P = X times a constant. Similarly "Indirectly" indicates an indirect or involved function.

Altho, strictly speaking, the "rate of production" is not a property of the product, it simplifies the analysis to treat it as such, thus helping to bring out its importance and degree of independence.

Practical Limits of above Quantities:—

"A" = 40-60 lbs. per hour.

"B" = 60-80% PbO

"C" = 3. - 4. sp. gr.

"D" = 12.5-15 Rev. per min.

"E" = ——————Ordinary "St. Joe" lead seems to work well. "Doe Run" was quite unsatisfactory.

"F" = 1800-2400 lbs.

"G" = 60-80° Fahr. This emphasizes the necessity of adequate ventilation during warm weather.

"H" = 165-185° Fahr. The greater the internal ventilation thru the machine the greater the speed at which it can be operated without exceeding its temperature limit, thus increasing the ease of control and the output. The German design did not show this.

"I" = ——————

"J" = 60 mesh to ——————. 60 is the fine limit, as under some conditions the meshes tend to clog. It is possible to produce useable material without the screen, but this so narrows the other limits that it does not appear very practical to do away with it entirely. Note that the screen does not determine the fineness of the material, but its *only function* appears to be to delay the delivery of the material and hence to assist in its proper oxidation.

"K" = Besides delivering the material, this tube plays an even more important part in the oxidation than the screen. If the tube is too short and its angle with the horizontal too steep, the material is delivered in a hot, semi-oxidized condition, and

will be quite apt to get on fire in the container. On the other hand too long a tube with insufficient slope is apt to become clogged with material.

"L"_____.

GENERAL OPERATIONS.

The general rules of operation during experimental runs are so well understood that it does not seem necessary to go into them in detail. If, however, it is decided to run the mill for a continuous output there are some points to be emphasized.

Run at the highest speed and load consistent with a useable product.

Control the character of the product as far as possible by the external and internal ventilation systems, installing fans if necessary.

It brings down the temperature better and diminishes the output less, to reduce the load rather than the speed.

It is safe to judge the oxidation by the color and the tendency to heat in the container. Under normal conditions the container, at the level of the material, is too hot to bear the hand on, but not hot enough to scorch the skin if touched quickly. Normal material has a color ranging from a velvety bluish green to a medium light yellowish green.

STORING THE PRODUCT.

Samples of lead dust made nine months ago and stored in glass stoppered bottles show apparently no change, whereas the same materials turned to litharge in less than a week when stored in paper bags.

Hence the successful dry storage of the material depends purely on the tightness of the container. The present steel packages would probably be entirely satisfactory if they were provided with heavy steel or cast iron top rims and with proper rubber or lead gaskets.

Similarly any fluid which tends to prevent the free access of air will delay the oxidation. It is possible, but does not look very practical, to store under water. It should be noted in this connection that damp material oxidizes more readily and more completely than dry material.

No definite limit of oxidation has yet been established beyond which the material does not make good positives, and experiments should be made to determine this.

It seems likely that material which has kept badly in storage will make entirely normal negatives and it would be well to make a complete series of experiments along this line.

WEK.L
7-24-17

DEFENDANT'S EXHIBIT NO. 111.

Patent No. 41728
Classification No. 154.
Date of application—November 21, 1920.
Patent issued—February 13, 1922.
Patent owner (inventor)

Genzo Shimadzu
420 Todoin Goike Noboru Funaya Street
Jokyo ku, Kyoto, Japan

DETAILED DESCRIPTION

A Method of Manufacturing Very Reactive Lead Powder

Character of the Invention and Its Main Object

This invention consists in placing pieces of metallic lead inside of a rotating vessel, rotating the vessel, and grinding them to bits by means of the frictional rubbing of the lumps of lead on one another and on the inside walls of the vessel, to manufacture fine lead powder. Its object is the simple and inexpensive manufacture of chemically reactive, irregularly shaped lead powder without the process of crushing.

Detailed Explanation of the Invention

In the manufacture of metallic powders up to the present time, the usual procedure has been either to crush by the method of crushing and pounding or, as in the method of manufacturing zinc powder, to mix the vapors of the metals with air etc. and condense them into powder-like solids; however, these products are not only large and rough granules whose surfaces are changed to a hard and tough character, but the former product shows a pressed together condition so that it is very difficult for it to act readily with chemical reagents, and the surface of the latter is easily oxidized and thus has the defect of being covered with oxidized material. But even supposing this is mashed and formed into a powder, it is very large and rough and due to cracking, etc. the

purity of the product is in danger of being very greatly reduced. On this account, no matter what is done, as might be expected from these inventions, it is impossible to supply a specific chemical material. The present invention is not dependent on these methods and is an application of the use of the well-known rotating vessel used in pulverizing rocks. That is to say, lumps of lead are thrown into a rotating vessel and ground into a powder by means of the frictional rubbing of the lead lumps on one another and on the inner walls of the rotating vessel, due to rotation of the vessel; moreover, the degree of fineness of the lead can be conveniently governed by the amount of lead lumps put in.

One example of the manufacture of lead powder by the method of the present invention will be given.

An iron cylinder 60 inches in diameter and 60 inches in length and which can be made to rotate is mounted horizontally and 250 Kwans of lead balls having a diameter of one and one half inches thrown into it; then during the time it is rotated at about 25 revolutions per minute, the lead balls rub on one another and on the inner walls of the vessel, so that they are gradually reduced by friction to small particles, and in an hour's time about 10 Kwans of irregular, fine powder is made and can be collected.

On account of the fact that the metallic powder manufactured by the method of the present invention is very irregular in shape and exceedingly fine with a comparatively large surface area, it can oxidize readily and, depending on the amount of spontaneous combustion produced, it is sometimes necessary to dissipate the head of friction by installing a cooling system in the rotating vessel.

An important point of this invention is the reduction of lumps of lead to fine particles in a rotating vessel by their frictional rubbing on one another and on the inner walls of the vessel, while it is rotating, without crushing or smashing the metals as in methods used heretofore; and in contrast to the previous methods, this has the following special features:—

(1) The power required is small, the process is simple and the degree of fineness of the powder can be conveniently controlled;

(2) The degree of fineness is very different; that is, the product resulting from this invention is very fine and, moreover, the losses in the degree of purity are small;

(3) The chemical action is very violent and the powder can be oxidized in air, for on experiment the condition of the particles is irregular, they are rough and the surface area is very large, and because of the amount of natural ignition the product can be very economically used in various chemical materials, such as litharge and as electrode material in storage batteries and paint material.

(4) The product of this invention is very effective as an intermediate catalytic with powerful contact action, as a material for reducing the polarity of a battery and a material for restoring the polarify of a battery, and as a material for supplying oxygen.

Scope of Patent Claims

(1) In order to achieve the purpose recorded above, a method of manufacturing chemically reactive lead powder is claimed, a special feature of which is throwing lumps of lead into a rotating vessel and by rotation of the vessel grinding lumps of lead to small pieces.

(2) In order to achieve the purpose as recorded above, a method of manufacturing chemically reactive powder is claimed which consists in placing round lumps of lead in a rotating vessel and reducing them to small particles by means of the frictional rubbing of the balls on one another and on the inner walls of the vessel when this is rotated.

DEFENDANT'S EXHIBIT NO. 112.

Patent No. 42563 (Addition to Patent No. 41728)
Classification No. 154
Date of Application—November 27, 1920
Patent Issued—May 10, 1922
Patent Owner (Inventor)

Genzo Shimazu
420 Todoin Goike Noboru Fnaya Street,
Jokyoku, Kyoto, Japan.

DETAILED DESCRIPTION

A Method for the Continuous Manufacture of Very Reactive Lead Powder

Character of the Invention and its Main Object

This invention is an improvement of that covered by Patent No. 41728 and consists of a method for manufacturing lead powder which is very reactive chemically by placing lumps of metallic lead inside a rotating vessel, and, while rotating the vessel to reduce the lead to small particles by frictional rubbing, blowing in some air or other inactive gases to cause the small particles to fly out of the vessel; and then collecting them. The purpose or object briefly is to obtain (extract) a product, the measured and observed specific gravity of whose small particles is fixed, to prevent a decrease in the rubbing action (or friction), and to increase the efficiency of the production.

Detailed Explanation of the Invention

This invention is an improvement over the one covered by patent No. 41728 and consists of blowing air or some other kind of inactive gas like nitrogen into a rotating vessel, while it is rotating, to forcibly blow out all the particles ground sufficiently small, thus avoiding considerable trouble and eliminating the decrease of the frictional action due to an accumulation of the powder inside the vessel. At the

same time, the size of the particles can be governed by the velocity of the gas blowing in. Here is given a specific case:—

A hollow iron cylinder 60 inches in diameter and 60 inches in length and which can be made to rotate is constructed horizontally. Within the cylinder is placed air jet pipe with small holes pierced in it. A door for inserting the material is made in one side of the cylinder, and a door for removing the finished product is made in the other side. Lead balls having a diameter of 1½ inches are supplied to the cylinder through the first door at the fixed rate of about 27 kan per hour continuously. While the cylinder is rotating at the rate of 25 revolutions per minute, air at a pressure of 2.5 pounds to the square inch is jetted out from the air jet tube, and since the lead balls are gradually ground to small pieces these are blown out through the outlet door to the outside of the cylinder and directed to a suitable place and collected. In this manner, 27 kan of lead powder having no regular or definite shape with an ordinarily observed density or specific gravity of approximately 2.3 can be produced per hour.

Fine, porous, irregularly shaped lead powder made in conformity with the original patent No. 41728 is liable to ignite spontaneously due to the heat of friction on the inside of the rotating vessel. But this defect is not only eliminated by the present invention by blowing in air or some other inactive gas with a resultant cooling effect, but the decrease in the frictional action due to an accumulation of the small particles which are produced is avoided because these particles are blown outside the rotating vessel; moreover, since the work is done continuously, the efficiency the manufacturing process can be very much increased.

While the main point of this invention is the placing of lumps of metallic lead inside the rotating vessel and due to its rotation alone, without crushing, reducing the size of these lumps, a special feature of the invention is the blowing of the small particles out from the vessel by means of

the air or other gases. The merits of the invention are as follows:

(1) The small particles produced during the frictional rubbing are continuously forced out from the vessel by the currents of air and gas, and due to the cooling effect, the product is not liable to attack by the air occasioned by the heat generated during the work;

(2) There is no reduction in the frictional action due to the accumulation of small particles, and the grinding efficiency can be increased;

(3) It is easy to regulate the size of the product, since, by adjusting the force of the incoming currents, particles of a fixed density can be blown out by fanning;

(4) The raw material can not only be supplied at a constant rate and the work go on continuously because there is no trouble in opening the vessel, for the product is forced out by the strength of the currents, but the conditions on the inside of the rotating vessel con be approximately controlled and the frictional action made constant, so that a product can be obtained whose measured and observed specific gravity (density), etc., is always constant.

Scope of Patent Claims.

(1) In order to achieve the object recorded earlier in this record, a method of manufacturing chemically reactive lead powder is claimed, a special feature of which is throwing lumps of lead into a rotating vessel, and blowing currents of air or other inactive gases into the vessel during rotation to force the small particles produced by rubbing out of the vessel.

(2) In order to achieve the purpose recorded above, a method of manufacturing chemically reactive lead powder is claimed, as stated in the previous paragraph, which governs the size of the particles by means of the velocity of currents of inblówing air.

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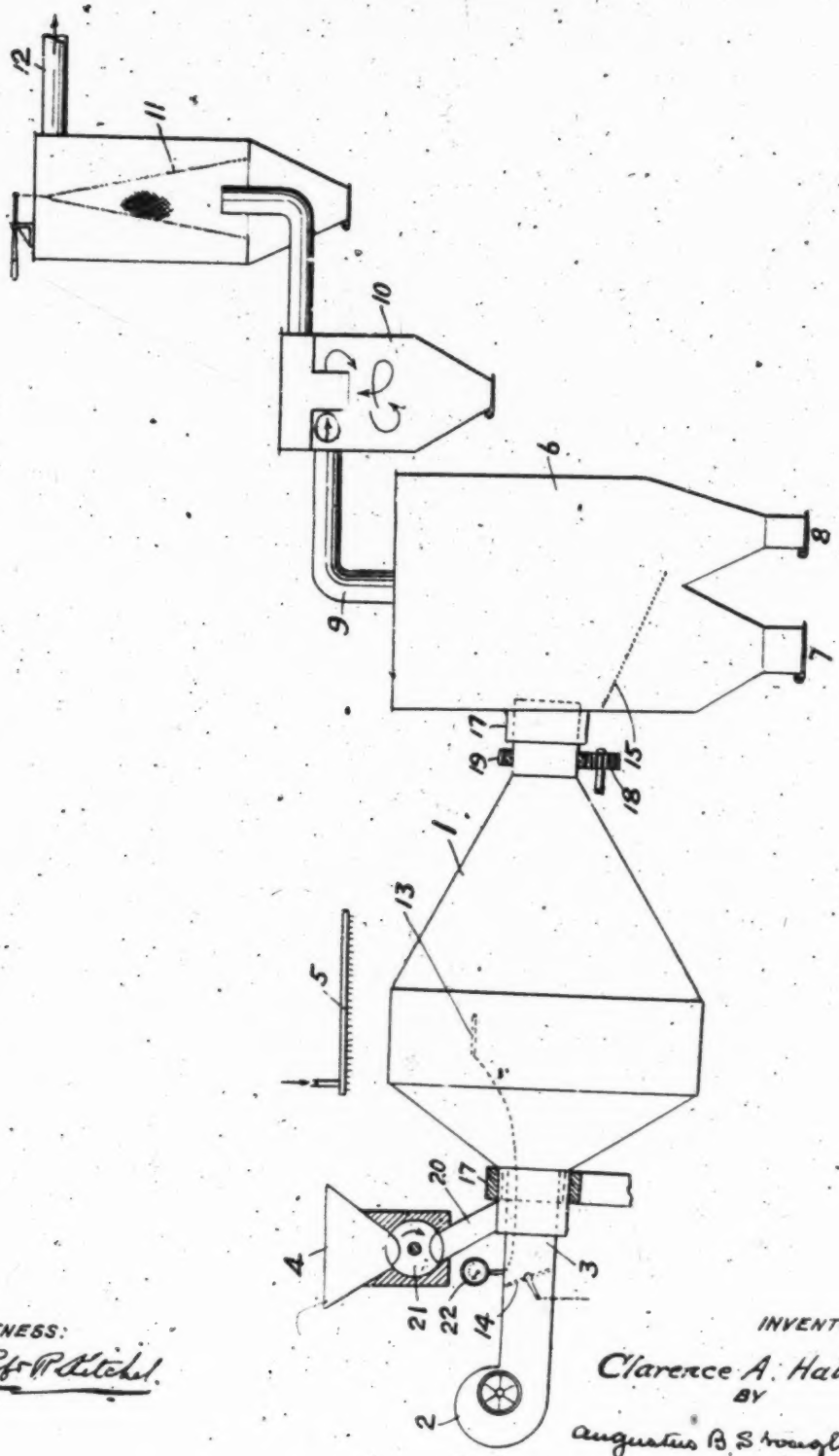
(3) In order to achieve the purpose recorded above, a method of manufacturing chemically reactive lead powder is claimed, as stated in the preceding paragraphs, which provides for continuously or periodically supplying raw material in the form of lumps of lead at a given rate, and blowing out the finished particles by the force of the wind so that the work is done continuously.

July 3, 1928. 1,675,345

C. A. HALL

APPARATUS FOR MAKING LEADEN POWDER

Original Filed March 29, 1924



WITNESS:
Robt W Mitchell

INVENTOR
Clarence A. Hall
BY
Augustus B. Stoughton
ATTORNEY.

Patented July 3, 1928. 1,675,345

UNITED STATES PATENT OFFICE.

CLARENCE A. HALL, OF PHILADELPHIA, PENNSYLVANIA.

APPARATUS FOR MAKING LEADEN POWDER.

Application filed March 29, 1924, Serial No. 702,890. Renewed December 2, 1927.

The principal object of the present invention is to provide an apparatus for use in the manufacture of leaden powder of the order of lead oxides. Another object of the invention is to provide such an apparatus with appropriately independent controls whereby the character and quality of the product in respect to oxygen content can be varied to establish different products and to permit of the manufacture of any established product in such a way that it is of uniform quality. A further object of the invention is to provide for the dissipation of the heat evolved by quantity production in excess of the heat permissible for the successful accomplishment of the chemical reaction. Additional objects of the invention will appear from the following description at the end of which the invention will be claimed.

The invention comprises the improvements to be finally claimed and presently described in connection with the accompanying drawings forming part hereof and in which the single figure is a view partly in section, but principally in side elevation, schematically or diagrammatically illustrating features of apparatus embodying or containing one form of the invention.

In the drawing, 1 is a hollow drum of the general form of reversely disposed conic frustums extending from a cylindrical center portion. This drum provides a closed curved wall. The drum is revoluble about a substantially horizontal axis. However, as shown, the axis is slightly inclined from left to right in the direction of feed of the solid material. 17 indicates bearings in which the drum is revoluble. Toothed gearing 18 represents a means for driving the drum and the part 19 of this gearing which is carried by the drum is shown as broken away for the sake of clearness although it extends all the way around the surface of the drum. 4 is a feeder at the inlet end of the drum and it communicates with the interior of the drum by way of the passage 20 and through the hollow trunnion of the drum. The rotary pocketed element 21 is a means for enclosing the feeder against the entrance of air while permitting of the introduction of balls or lumps of lead into the drum. 6 is an enclosed delivery hopper at the outlet end of the drum and it communicates with the interior of the drum through a hollow trunnion. The delivery hopper 6 is provided with stoppered outlets 7 and 8 and with a screen 15 which operates to deliver fine material, the finished product, at the opening 7, and coarse material at the opening 8, and this coarse material, when produced and if desired, may be returned to the interior of the drum for further treatment. 5 is a means, shown as a water spray device, for applying cooling fluid to the exterior of the curved wall of the drum. The fan 2, the conduit 3, and the pipe 9 constitute a means for passing a stream of air axially through the drum in either direction and, as shown, the direction is from left to right. 10 is a dust catcher, and 11 is a dust bag having an outlet 12 to the atmosphere, and these dust catching devices are arranged in series with the outlet of the pipe 9. 14 is a damper for controlling the volume of air flowing through the drum, and 13 is a thermometer arranged generally centrally of the interior of the drum and provided with a dial 22. In general there is provided an air containing rumble 1 rotated at a speed appropriate for quantity production, and there are means for dissipating heat evolved by the action of the rumble on lead balls or lumps contained therein in excess of the heat appropriate for the chemical reaction. These heat dissipating means operate independently of the speed of revolution of the rumble, and since they comprise air control and cooling fluid application they are independent of each other.

In use the air containing rumble 1 supplied with balls or lumps of lead is rotated at a speed determined for quantity production of the leaden powder. This results in the evolution of heat in excess of that appropriate for the formation of powdered lead oxide. The excess heat is dissipated either by the application of fluid to the exterior of the rumble, for example at 5, or by control of the volume of air as at 14, or by the combined use of both of these instrumentalities. When the rumble is of the form shown, it is necessary to feed lead balls or lumps into it, in order that the powdered oxide will escape from it into the delivery hopper 6, from which it is removed as by way of the outlet 7 for use. The dust caught in the dust catchers 10 and 11 may also be collected and used. If coarse material is removed from 8 it can be returned to the interior of the rumble 1 for further treatment. The thermometer 13 is a means

for ascertaining the temperature in the interior of the drum 1, so that the necessary controls 14, 5, or both, can be regulated. In some cases the speed of revolution of the drum can be reduced in order to avoid the evolution of too much heat for the successful production of leaden oxide but reduction of the speed of revolution of the drum 1 is accompanied by diminution in the quantity of production.

It will be obvious to those skilled in the art to which the invention relates that modifications may be made in details of construction and operation without departing from the spirit of the invention which is not limited as to those matters or otherwise than as the state of the prior art and the appended claim may require.

I claim:

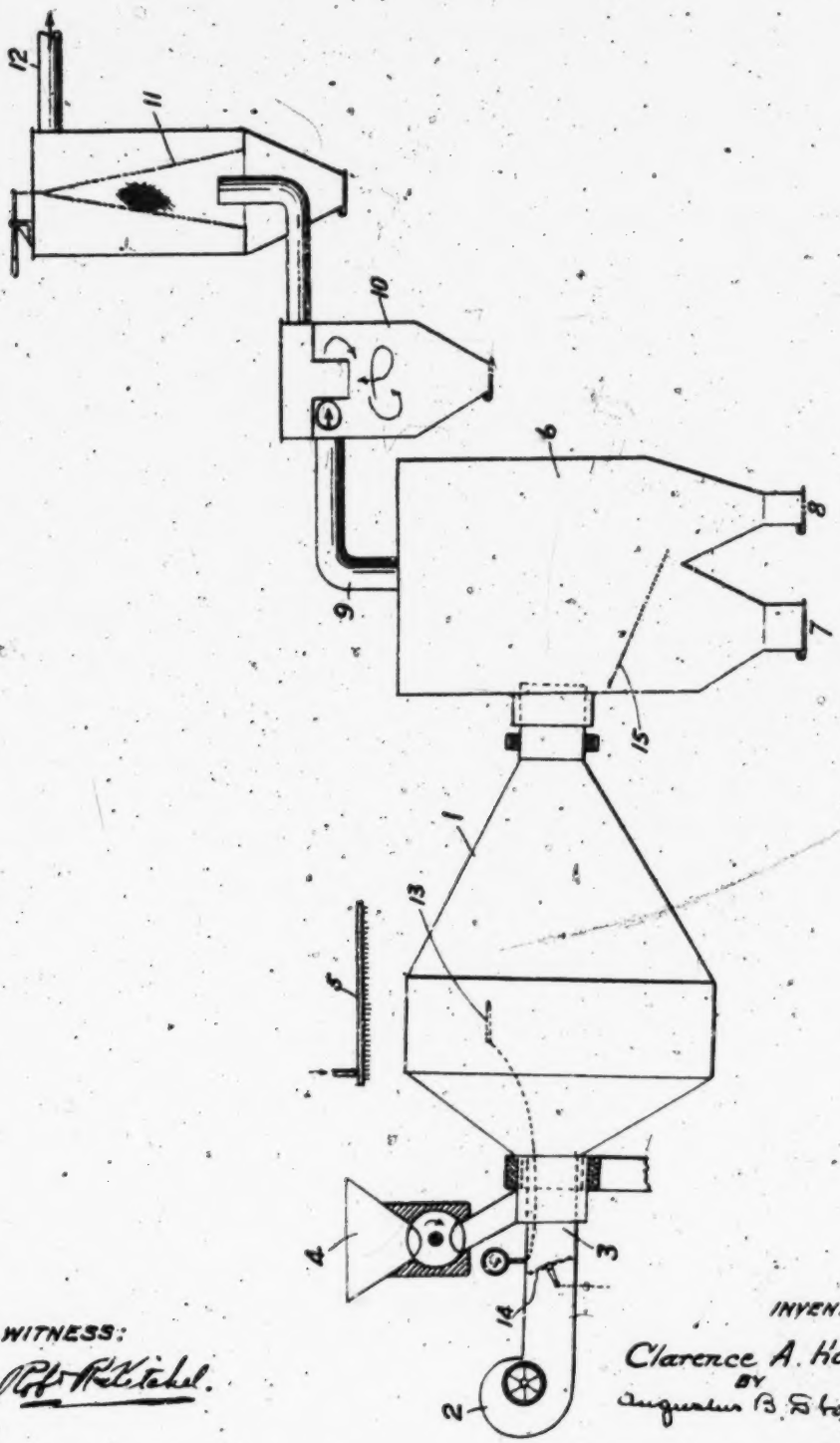
Apparatus for making leaden powder comprising in combination a hollow drum of the general form of reversely disposed conic frustums and having a closed curved wall and being revoluble about a substantially horizontal axis, means for rotating the drum, an enclosed feeder at the inlet end of the drum and in communication with the interior of the drum, an enclosed delivery hopper at the outlet end of the drum and in communication with the interior of the drum, controlled means for spraying cooling fluid onto the exterior of the drum, and controlled air connections for passing a stream of air axially through the drum, said cooling fluid means and said air connections being independently operatable for dissipating the excess of evolved heat over the limited degree of heat appropriate for the success of the chemical reaction between the air and lead.

CLARENCE A. HALL

Nov. 22, 1932. C. A. HALL 1,888,823

LEAD OXIDE POWDER AND METHOD OF MAKING THE SAME

Original Filed March 29, 1924



WITNESS:

INVENTOR

Clarence A. Hall

BY

ATTORNEY.

UNITED STATES PATENT OFFICE

CLARENCE A. HALL, OF PHILADELPHIA, PENNSYLVANIA

LEAD OXIDE POWDER AND METHOD OF MAKING THE SAME

Application filed March 29, 1924, Serial No. 702,889. Renewed December 24, 1928.

Objects of the present invention are, first, to provide a lead oxide powder of the order of lead oxides used extensively in the arts but much less expensive to produce and capable of replacing them for many purposes such as in the manufacture of storage batteries and paints and in some cases with beneficial and improved results; and second, to provide an expeditious, comparatively inexpensive and reliable method of making such lead oxide powder of substantially uniform qualities.

Other objects of the invention will appear from the following description and the invention will be claimed at the end hereof.

In the following description reference will be made to the accompanying drawing comprising a single figure and illustrating, partly in section but principally in side elevation, apparatus by means of which the product can be made in accordance with the method.

The product is an amorphous fine powder. The degree of its fineness can be illustrated by saying that it will pass through a 200 mesh. The powder is olive gray in color and it is unstable or highly chemically reactive if exposed to air, more particularly moist air of the atmosphere, and spontaneously oxidizes or approaches litharge. The specific weight (weight of a given volume of powder in terms of the same volume of water) of the product is approximately from 2.10 to 2.25, and it contains from 50% to 80%, or the major portion, of oxide calculated as litharge. The product in sealed drums, such as are usually used for lead oxides, will remain stable for a week or so. Some of the product is absorbed in a dilute solution of acetic acid and some of it remains as metallic lead of spongy form. The quality of the product is very uniform and when used for paints its instability and property of oxidizing in the air is of value and its uniformity of quality is of value not only in the paint industry but also in battery production. The product differs from the five well known oxides of lead although it may be a mixture of them or some of them and may possibly contain, in addition to metallic lead, lead in somewhat intermediate state or condition or lead suboxide. While a number of its identifying characteristics have been set forth, the clearest and best way to identify the product appears to be reference to its process of production or to the process of which it is the result.

In the drawing 1 is a double cone mill of the Hardinge type and it is revolved around an axis in general horizontal but very slightly inclined to the horizontal towards its outlet end. 2 is a blower having a discharge 3 into the casing 1. 4 is a hopper for feeding balls or lumps of lead into the mill and it is of the type that excludes the entrance of air. 5 is a device for putting water on the exterior of the mill. 6 is a discharge hopper fitted with a stoppered outlet 7 for the leaden powder and with a stoppered outlet 8 for coarse material which is returned to the mill. The hopper 6 is fitted with an air off-take 9 which may include a dust catcher 10 and a dust bag 11 from which air escapes at 12. The devices 10 and 11 serve as a means for recovering some of the product. 13 is a thermometer device for ascertaining the temperature existing in the mill. 14 is a shutter for controlling the air supply. The temperature can be controlled by the discharge of water at 5 and also by adjustment of the damper 14, and adjustment of the damper 14 is one way in which the supply of air and consequently the available oxygen content at the reaction zone can be adjusted. 15 is a screen.

While the described apparatus is subject to considerable modification and change, for example, in the direction of travel of the air, still it will be referred to in describing the method of the invention which may be said to consist in subjecting lumps or balls of metallic lead to mutual attrition and oxidation at a temperature limited to approximately under the melting point of lead and in the presence of a supply of air.

For the sake of further description it may be said that good results can be produced as follows: With a drum 1, six feet in diameter and ten feet in length, fourteen revolutions per minute are appropriate. One hundred and fifty cubic feet of air per minute are passed through the mill which is charged with 19,000 pounds of balls of metallic lead

of ⅜ inch in diameter. Substantially 480 pounds per hour of product are produced and somewhat less than 480 pounds of lead balls are fed into the mill per hour having in mind the increase in weight due to the oxidation of lead. The temperature is kept at less than 360° F. by water discharged from 5 onto the mill. It may be said by way of illustration that in the reaction zone, which may be taken to be located generally at the center of the mill, the air is substantially 6% oxygen content, whereas when introduced from the atmosphere it is about 20% oxygen content. From the foregoing description it will be apparent that the pieces or balls of metallic lead are reduced to powder by mutual attrition and that the powder is oxidized under controlled temperature and available oxygen conditions.

It is not the intention to limit the invention in respect to the size of the lumps or balls of metallic lead or to the exact size and speed of the mill, or to the quantity of the air, or to the temperature of the reaction, as they may be varied in accordance with practical requirements. Control of these factors, however, is the spirit of this invention, whereby any product once established may be kept substantially uniform in quality. The direction of the travel of the solid material undergoing process is generally axial of the mill and so is the direction of the stream of air, whether it flows counter to or with the solid material.

The apparatus shown and described is not claimed herein because it forms the subject-matter of my application, Serial No. 702,890.

The invention is not limited to the details of procedure herein descriptively referred to nor in respect to matters of mere form, nor otherwise than as the prior art and the appended claims may require.

I claim:

1. As an article of manufacture an amorphous lead oxide powder of olive gray color and of specific weight approximately 2.15 and being the product of the mutual attrition of metallic lead lumps at a temperature under 360° F. and in the presence of a controlled stream of air.

2. The process of making lead oxide powder of olive gray color and of amorphous structure which consists in subjecting balls or lumps of metallic lead to mutual attrition by rumbling them while confined by the closed wall of a vessel in a stream of air passing through said vessel, and controlling the temperature by the application of cooling fluid to the exterior of said wall.

3. The process of making lead powder of the order or lead oxides and of amorphous structure which consists in subjecting balls or lumps of metallic lead in a dry state or condition to mutual attrition in a stream of air thereby evolving heat in excess of that appropriate for the reaction and limiting the resultant heat to a degree appropriate for the reaction by controllably dissipating heat in excess of that appropriate for the reaction, continually introducing fresh supplies of lumps or balls, and drawing off the product.

4. The process of making an oxidized lead powder which consists in establishing and maintaining a triturating and oxidizing zone or region within a vessel closed to the atmosphere by rumbling a mass of lumps or balls of lead in a dry state or condition in said vessel and by passing a regulated stream of air axially therethrough and by controlling the temperature thereof, feeding lumps or balls of lead to said region, and axially withdrawing oxidized powder from said region, substantially as described.

CLARENCE A. HALL.

CLERK'S CERTIFICATE.

UNITED STATES OF AMERICA,
EASTERN DISTRICT OF PENNSYLVANIA, } *Sct.*
THIRD JUDICIAL CIRCUIT,

I, WM. P. ROWLAND, Clerk of the United States Circuit Court of Appeals for the Third Circuit, DO HEREBY CERTIFY the foregoing to be a true and faithful copy of certain of the original exhibits submitted to this Court at the argument before it in the cases of The Electric Storage Battery Co., Defendant-Appellant, v. Genzo Shimadzu and Northeastern Engineering Corporation, Plaintiff-Appellee, and Genzo Shimadzu and Northeastern Engineering Corporation, Plaintiff-Cross-Appellant, v. The Electric Storage Battery Co., Defendant-Cross-Appellee, (Nos. 6309 and 6336) on file, and now remaining among the records of the said Court, in my office.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the seal of the said Court, at Philadelphia, this twenty-eighth day of October, in the year
(Seal) of our Lord one thousand nine hundred and thirty-eight and of the Independence of the United States the one hundred and sixty-third.

WM. P. ROWLAND,
Clerk of the U. S. Circuit Court of Appeals, Third Circuit.

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IN THE

Supreme Court of the United States

No. 441 October Term, 1938.

THE ELECTRIC STORAGE BATTERY CO.,
Petitioner,

v.

GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION,
Respondents.

Petition for a Writ of Certiorari and Brief in Support Thereof.

AUGUSTUS B. STOUGHTON,
HUGH M. MORRIS,
A. F. KWIS,
E. S. FARNUM, JR.,
Counsel for Petitioner.

INDEX.

Page

SUMMARY STATEMENT OF MATTER INVOLVED 1

REASONS RELIED ON FOR ALLOWANCE OF THE WRIT 7

BRIEF IN SUPPORT OF PETITION 9

I. The Opinions of the Courts below 9

II. Jurisdiction 9

III. Statement of the Case 10

IV. Specification of Errors 10

ARGUMENT 13

Summary of Argument 13

Point I. In holding that in the ascertainment, under the Patent Statutes of the United States, of the date of an invention made abroad, such Statutes do not proscribe all evidence of invention abroad other than that derived from patents, printed publications, or patent applications within the terms of R. S. 4887, the Court below has decided an important question of Federal Law which has not been, but should be, settled by this Court .. 13

Point II. In holding that United States Patents are not invalidated by commercial use by others in this country, of the inventions patented, for more than two years before the actual filing of the applications for such patents, the Court below has decided a Federal question in a way probably in conflict with applicable decisions of this Court, as well as of another Circuit Court of Appeals 21

Page

Point III. In holding valid a United States Patent granted to one who had made an invention in a foreign country, but who withheld and suppressed it for a long period of time and did not file an application for a United States Patent therefor until more than two years after the thing subsequently patented had been brought into commercial use by others in this country, the Courts below decided an important question of Federal law in a way probably in conflict with an applicable decision of this Court 23

CONCLUSION 25

APPENDIX 27

TABLE OF CASES.

	Page
Appliance Co. v. Equipment Co., 297 U. S. 387, 392	9
Badische Anilin & Sode Fabrik v. A. Klipstein & Co., 125 Fed. 543	19
Bell v. Brooks, 19 O. G. 290, C. D. (1881) 4	14, 15
Brush v. Condit, 132 U. S. 39, 49	22
Brush Electric Co. v. Julien Electric Co., 41 Fed. 679, 686	17
Carr v. Davids, 3 O. G. 440, C. D. (1873) 79	14
Chambers v. Duncan, 9 O. G. 741	14
Claude Neon Lights Co. v. Rainbow Light, 47 Fed. (2d) 345	19
DeKando v. Armstrong, 37 App. D. C. 314, 321	14
Douglas v. Cunningham, 294 U. S. 207, 209	10
Egbert v. Lipman, 104 U. S. 333	22
Electrical Accumulator Co. v. Brush Electric Co., 52 Fed. 130, 134 (C. C. A. 2)	17
Electrical Accumulator Co. v. Julien Elec. Co., 38 Fed. 117	17
Gandy v. Main Belting Co., 143 U. S. 578	18
Gayler v. Wilder, 10 How. 477, 496	18
Grant et al. v. Raymond, 6 Pet. 218, 243	18
Hall v. Shimadzu, 59 Fed. (2d) 225	5
Hanifen v. E. H. Godshalk, 78 Fed. 811	19
Hanifen v. Price, 96 Fed. 435	19
Hovey v. Hufeland, 2 O. G. 493	14
Ireson v. Pierce, 39 Fed. 795, 798	17
Jay v. Weinberg, 250 Fed. 469, 472	17
Keller v. Adams-Campbell Co., 264 U. S. 314	9
Kendall v. Winsor, 21 How. 322, 327	18, 20, 24
Lauder v. Crowell, 16 O. G. 405	14
Lorimer v. Erickson, 227 O. G. 1445	14

TABLE OF CASES—Continued.

	Page
Manning v. Cape Ann Isinglass & Glue Co., 108 U. S. 462	22
N. Y. Life Ins. Co. v. Viglas, 297 U. S. 672, 676	10
Patents Selling & Exporting Co. v. Dunn, 213 Fed. 40	17
Prudence Co. v. Fidelity Co., 297 U. S. 198, 205	10
Rebuffat v. Crawford, 68 Fed. (2d) 980, 982	14
Smith v. Barter, 7 O. G. 1, C. D. (1875) 5, 7, 8	14, 15
Thomas v. Reese, 17 O. G. 195	14
Triplett v. Lowell, 297 U. S. 638, 639	9
Tucker v. Davis, 2 O. G. 224	14, 15
Twyman v. Radiant Glass Co., 56 Fed. (2d) 119, 121	22
Vacuum Engineering Co. v. Dunn, 209 Fed. 219 (CCA 2)	17
Welsbach Light Co. v. American Incandescent Lamp Co., 98 Fed. 613	19
Westinghouse Mach. Company v. General Electric Co., 207 Fed. 75, 78	17
Wilson v. Sherts, 81 Fed. (2d) 755, 760	14, 16

STATUTES CITED.

	Page
R. S. 4886 (See Appendix)	6, 13, 15, 19, 20, 21
R. S. 4887 (See Appendix)	6, 7, 11, 13, 14, 15, 16, 19, 21
R. S. 4920 (See Appendix)	13, 17
R. S. 4923 (See Appendix)	13, 17
R. S. 4915	17
Section 240(a) of the Judicial Code as amended by Act of February 13, 1925 (28 U. S. C. § 347(a))	9

IN THE

Supreme Court of the United States.

No. . October Term, 1938.

THE ELECTRIC STORAGE BATTERY CO.,
Petitioner,

v.

GENZO SHIMADZU AND NORTHEASTERN ENGINEERING CORPORATION,
Respondents.

Petition for a Writ of Certiorari.

To the Honorable the Chief Justice of the United States and the Associate Justices of the Supreme Court of the United States:

Petitioner, The Electric Storage Battery Co., respectfully prays that a writ of certiorari issue to the United States Circuit Court of Appeals for the Third Circuit to review a judgment of that Court filed on August 8, 1938, rehearing denied September 14, 1938, affirming the decree of the United States District Court for the Eastern District of Pennsylvania (Kirkpatrick, J.).

SUMMARY STATEMENT OF MATTER INVOLVED.

This is an infringement suit in equity upon six United States Patents* granted to Genzo Shimadzu, a subject of the Emperor of Japan and a resident of Japan.

*Patent	*Claims*	*Application Filed*	*Patent Issued*
1,584,149	1-2	Jan. 30, 1922	May 11, 1926
1,584,150	1-4, 6, 8-17	July 14, 1923	May 11, 1926
1,584,151	1-5	Apr. 18, 1924	May 11, 1926
1,584,152	1-2	Apr. 18, 1924	May 11, 1926
1,584,479	1-4	Feb. 20, 1923	May 11, 1926
1,896,020	10-11	Apr. 27, 1926	Jan. 31, 1933

The parties plaintiff are Shimadzu, as owner of the patents, and Northeastern Engineering Corporation, as exclusive licensee.

Defendant is The Electric Storage Battery Company, petitioner herein.

By its decree, the United States District Court for the Eastern District of Pennsylvania (Kirkpatrick, J.) adjudged (R. II, 1192)

Patent	*Claims*	*Decree*
1,584,149	1-2	valid and infringed,
1,584,150	1-4, 6, 8-13	valid and infringed,
1,896,020	10-11	valid and infringed.

The remaining claims in issue were adjudged valid but not infringed.

Both parties appealed to the Circuit Court of Appeals for the Third Circuit. The decree of the District Court was affirmed (R. II, 1226) upon the opinion of the District Court (R. II, 1225).

A petition for rehearing was filed by petitioner and denied by the Circuit Court of Appeals September 14, 1938. (R. II, 1255).

This petition pertains only to the claims held valid and infringed.

The claims here involved of Patents No. 1,584,149 and No. 1,584,150* have to do with the production of a fine powder of lead by the abrasion of larger pieces of metallic lead

*The Courts below found that the process of patent No. 1,584,149 differed from that of patent 1,584,150 in that the process of the former is carried out at room temperature and air is introduced into the mill to remove the powder from the mill, while in the latter, the process is carried out at elevated temperatures and air is introduced into the mill for oxidation purposes (R. II, 1166-7).

in a dry state in a rotating mill under specified conditions. The claims here involved of patent No. 1,896,020 are for apparatus for carrying out the process. The product, "lead dust," is used in the manufacture of plates for storage batteries (R. II, 1162).

The inventions of these patents were made by Shimadzu in Japan. (R. II, 1163).

The dates upon which he filed his applications for the patents in suit and the dates of their grant, were:

Patents	*Applied for*	*Granted*
1,584,149	Jan. 30, 1922	May 11, 1926
1,584,150	July 14, 1923	May 11, 1926
1,896,020	Apr. 27, 1926	Jan. 31, 1933

Shimadzu has no foreign patent for the same invention as his patent No. 1,896,020. The Courts below found that he had no foreign patent equivalent to his patent No. 1,584,149.

Japanese patent No. 60,825 to Shimadzu issued June 19, 1924. It was applied for February 3, 1923, which was within twelve months of the filing, on July 14, 1923, of application for United States patent No. 1,584,150.

The Courts below found (R. II, 1172) that it

"corresponds very closely with U. S. '150."

Petitioner contended that Japanese patent No. 42,563, applied for November 27, 1920, and granted May 10, 1922, was for the same invention as that of patent in suit, No. 1,584,150, which was applied for July 14, 1923, and whose reduction to practice in Japan the Courts below found was in August 1919. In denying this contention of petitioner, the Courts below said (R. II, 1172):

"For whatever it may be worth, it is pretty clear that the plaintiff himself did not understand that, when he applied for Japanese '563, he was taking out a patent on the same process which appears in U. S. '150, because subsequently, in Japan, he took another patent, No. 60,825, which corresponds very closely with U. S. '150, and, being within the year, does not invalidate it. *We are not concerned with the motives which prompted him,* in taking out the '563 patent, to confine it to a single step of mechanical removal of the dust from the drum, and *to withhold the really essential steps of the invention for later patenting. It is sufficient to say that he had the right to do this if he chose.*" *

Shimadzu made no disclosure of his inventions to anyone in the United States before he filed his applications for his United States patents. His inventions were not patented or described in any printed publication in this or any foreign country, prior to the filing of his application for the patents in suit.

The defenses included (1) prior knowledge and use by others in this country before Shimadzu's invention, (2) that Shimadzu was not the first inventor of the thing patented, and (3) public use in this country for more than two years prior to the filing of the application for patent No. 1,584,150 (R. I, 34, 35).

Petitioner is the manufacturer of the "EXIDE" batteries. It has been engaged in manufacturing storage batteries in Philadelphia since the latter part of the last century.

Its employees were leaving from time to time. At the trial plaintiffs called as their witness, one Cooper, a for-

*Italics throughout petition and brief are counsel's, unless otherwise indicated.

mer employee of petitioner, to describe petitioner's process and apparatus (R. I, 401).

Petitioner has used the same process, and Hardinge Mills for carrying out its process, since early in 1921.

The Courts below found, (R. II, 1192):

> "It is therefore plain that there is no evidence of anything beyond an experimental use by the defendant earlier than about the middle of the year 1921. . . . *Commercial production* (by petitioner)* by the Hardinge Mill with its forced air draft undoubtedly involved the use of the plaintiff's patent, *and June 1921 may be fixed as the date when that began.*" **

---

*Parenthetical expressions throughout petition and brief are counsel's.

**The Hardinge Mill was installed and operated under the direction of Mr. C. A. Hall, who was employed therefor by petitioner. In March 1924, Mr. Hall applied for a patent for the apparatus which eventuated in patent to Hall No. 1,675,345 (PX 17). In March 1924, Mr. Hall also filed an application for the Hardinge Mill process which included rumbling lead balls in a rotating mill in the presence of air currents and a controlled elevated temperature, and this application eventuated in patent to Hall 1,888,823 (PX 18).

While the Hall application was pending, Shimadzu's patent 1,584,150 issued. Hall believed the processes of his application and Shimadzu's patent to be identical and added claims 2, 3, 4, 6, 9 to 17 inclusive from patent 1,584,150 to his application. An interference was declared. The Law Examiner held claims 9 to 13 inclusive unpatentable. The Board of Appeals of the Patent Office and the Court of Customs and Patent Appeals (Hall v. Shimadzu, 59 Fed. 2d, 225) awarded priority with respect to the remaining claims to Shimadzu upon the ground that an essential ingredient of those claims is suboxide of lead, and that Hall's process did not produce suboxide of lead. As a consequence, Hall's patent issued without those claims. The Courts below held that the process developed by Hall and used by petitioner commercially since June 1921, infringes claims 1 to 4, 6, 8 to 13 of Shimadzu's patent 1,584,150. (R. II, 1174-1175, 1177-1178, 1194).

June 1921, not only antedated all the patents in suit, all the United States applications therefor, the application for Japanese patent 60,825, any description in any printed publications, any foreign patents and any disclosure in this country by Shimadzu of the inventions patented in the patents in suit; but June 1921 was, as well,

> "more than two years before the date of the actual filing of the application in this country". (RS 4887).

for patent No. 1,584,150, and

> "more than two years prior to his application" (RS 4886).

for patent No. 1,896,020.

But, over the objection of petitioner, (R. I, 140), plaintiffs were permitted to adduce evidence for the purpose of showing that Shimadzu conceived and reduced the inventions to practice in Japan and the date thereof.

Upon such evidence, consisting of oral testimony, drawings and purported copies of alleged note book entries, the Courts below found, (R. II, 1166):

> "I fix the date of invention and successful reduction to practice (In Japan) as not later than August 1919 . . ."

At R. II, 1178, the Courts below held:

> "The plaintiff is undoubtedly entitled to rely for priority upon the date of invention and reduction to practice as found, *regardless of the fact that the invention was made in a foreign country.*"

The Court of Customs and Patent Appeals gave to Shimadzu as the date of his invention the date of his application. The Courts below permitted him to show conception and reduction to practice in Japan and gave him the date of August 1919.

REASONS RELIED ON FOR ALLOWANCE OF THE WRIT.

The discretionary power of this Court to grant the writ of certiorari is invoked upon the following grounds:

(1) In holding that in the ascertainment, under the Patent Statutes of the United States, of the date of an invention made abroad, such Statutes do not proscribe all evidence of invention abroad other than that derived from patents, printed publications, or patent applications within the terms of R. S. 4887, the Court below has decided an important question of federal law which has not been, but should be, settled by this Court.

(2) In holding that United States patents are not invalidated by commercial use by others in this country, of the inventions patented, for more than two years before the actual filing of the applications for such patents, the Court below has decided a federal question in a way probably in conflict with applicable decisions of this Court, as well as of another Circuit Court of Appeals.

(3) In holding valid a United States patent granted to one who had made an invention in a foreign country, but who withheld and suppressed it for a long period of time and did not file an application for a United States patent therefor until more than two years after the thing subsequently patented had been brought into commercial use by others in this country, the Court below decided an important question of federal law in a way probably in conflict with an applicable decision of this Court.

WHEREFORE, your petitioner respectfully prays that a writ of certiorari be issued out of and under the seal of

this Court, directed to the United States Circuit Court of Appeals for the Third Circuit, commanding said Court to certify and send to this Court, on a day to be designated, a full transcript of the record of all proceedings of the said Circuit Court of Appeals in the case numbered and entitled on its docket "No. 6309, The Electric Storage Battery Co. v. Genzo Shimadzu and Northeastern Engineering Corporation", to the end that this case may be reviewed and determined by this Court; that the judgment of the said Circuit Court of Appeals for the Third Circuit be reversed and that petitioner be granted such other and further relief as to this Honorable Court may seem meet and proper.

THE ELECTRIC STORAGE BATTERY CO.,

Petitioner.

By AUGUSTUS B. STOUGHTON,
HUGH M. MORRIS,
A. F. KWIS,
E. S. FARNUM, JR.,
Counsel for Petitioner.

Brief in Support of Petition.

I.

THE OPINIONS OF THE COURTS BELOW.

The opinion of the District Court (R. II, 1162) is reported in 17 Fed. Supp. 42.

The opinion of the Circuit Court of Appeals (R. II, 1223) has not been officially reported.

II.

JURISDICTION.

(a) The date of the judgment or decree of the Court below was August 8, 1938 (R. II, 1226).

Rehearing was denied by the Court below September 14, 1938 (R. II, 1255).

(b) The jurisdiction of this Court is invoked under Section 240(a) of the Judicial Code as amended by the Act of February 13, 1925 (28 U. S. C. § 347(a)).

(c) Cases believed to sustain the jurisdiction of this Court are:

With respect to "Reason" (1):

Keller v. Adams-Campbell Co., 264 U. S. 314, 318, 319;

Appliance Co. v. Equipment Co., 297 U. S. 387, 392;

Triplett v. Lowell, 297 U. S. 638, 639.

With respect to "Reasons" (2) and (3):

Douglas v. Cunningham, 294 U. S. 207, 209;
Prudence Co. v. Fidelity Co., 297 U. S. 198, 205;
N. Y. Life Ins. Co. v. Viglas, 297 U. S. 672, 676.

III.

STATEMENT OF THE CASE.

The attention of the Court is respectfully directed to the petition, which contains a statement of the facts of the case here pertinent. In the interest of brevity, the facts will not here be repeated.

IV.

SPECIFICATION OF ERRORS.

The Circuit Court of Appeals for the Third Circuit erred in the instant case,

(1) In holding that "the plaintiff is undoubtedly entitled to rely for priority upon the date of invention and reduction to practice as found, regardless of the fact that the invention was made in a foreign country."

(2) In not holding that one who has made an invention in a foreign country and obtained a patent therefor in this country may not, for the purpose of overcoming the defenses of prior knowledge and use in this country and that the patentee is not the first inventor, carry back the date of the invention to the actual time of invention in the foreign country.

(3) In holding that the date of the invention of the claims, held valid and infringed, of the patents in suit was not later than August 1919.

(4) In not holding that the patent statutes of the United States proscribe all evidence of invention abroad other than that derived from patents, printed publications, or patent applications within the terms of R. S. 4887.

(5) In not holding that testimony with respect to experiments and reduction of an invention to practice in foreign countries is incompetent and inadmissible under the patent statutes of the United States, to establish the date of invention of the thing patented or sought to be patented in this country.

(6) In not holding that under the patent statutes, the date of an invention made and first patented in a foreign country and thereafter in the United States upon a timely application, is the date of the application for the foreign patent.

(7) In not holding that the claims, adjudged valid and infringed, are invalid because the things patented were known and used by others in this country before the invention or discovery thereof by Shimadzu within the meaning of the patent statutes.

(8) In not holding that the claims, adjudged valid and infringed, are invalid because Shimadzu was not the first inventor.

(9) In not holding that the claims of Patents Nos. 1,584,150 and 1,896,020, adjudged valid and infringed, are invalid because the process and apparatus of said claims were in public used in this country for more than two years prior to the actual filing of the applications for said patents in this country.

(10) In not holding that the claims of Patents Nos. 1,584,150 and 1,896,020, adjudged valid and infringed, are in-

valid because the inventions of said claims were suppressed and concealed by Shimadzu for more than two years after the subject-matter of the said claims had been known and used commercially in this country.

(11) In holding any of the claims of any of the patents in suit valid and infringed and in granting respondents an injunction and an accounting.

Argument.

SUMMARY OF ARGUMENT.

The points of the argument coincide with the reasons relied on for allowance of the writ (P. p. 7). For the sake of brevity they are not repeated at this point.

Point I.

In Holding That in the Ascertainment, under the Patent Statutes of the United States, of the Date of an Invention Made Abroad, Such Statutes Do Not Proscribe All Evidence of Invention Abroad Other Than That Derived from Patents, Printed Publications, or Patent Applications Within the Terms of R. S. 4887, the Court Below Has Decided an Important Question of Federal Law Which Has Not Been, But Should Be, Settled by This Court.

The question thus decided by the Courts below involves the construction of the Patent Statutes of the United States, and particularly, R. S. 4886, 4887, 4920 and 4923,* as applied to the determination of the time when, and the acts by which, an inventor, who made his invention in a foreign country, brings his invention within the cognizance and operation of those Statutes.

The process and apparatus known and used commercially in Philadelphia by petitioner in June, 1921 were held by the Courts below to be infringements of plaintiffs' patents Nos. 1,584,149, 1,584,150 and 1,896,020. It would therefore seem manifest that all the claims of said patents held valid and infringed are invalid, because the inventions there-

*For convenient reference, these sections are set out in an appendix hereto.

of were known and used by others in this country before Shimadzu's invention or discovery thereof, unless Shimadzu can take the date of his invention back of June 1921.

Shimadzu's inventions were made in Japan. In June 1921 his inventions had not been described in any printed publication anywhere. No application for patent therefor has been filed in any country. His inventions had not then been disclosed to any person in this country, and were not so disclosed at any time prior to the filing of applications therefor in this country, long after June 1921.

Thus arises the naked question of law—whether the patent statutes of the United States permit or proscribe evidence of invention abroad other than that derived from patents, printed publications, or patent applications within the terms of R. S. 4887, to ascertain the date of an invention made abroad.*

For far more than half a century, the Patent Office and the Courts of the District of Columbia having appellate jurisdiction over the final decisions of the Patent Office have ruled in interference proceedings in an unbroken line of cases,[1] that unless and until inventions made abroad are

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*The cases hereinafter referred to are cited and discussed for the purpose of showing the various ways in which the statutes have been construed and that the resulting confusion should be dissipated and the proper construction of the statutes settled by a decision of this Court.

[1] Tucker v. Davis, 2 O. G. 224; Hovey v. Hufeland, 2 O. G. 493; Carr v. Davids, 3 O. G. 440, C. D. (1873) 79; Smith v. Barter, 7 O. G. 1, C. D. (1875) 5, 7, 8; Chambers v. Duncan, 9 O. G. 741, C. D. (1876) 82; 10 O. G. 787, C. D. (1876) 223; Lauder v. Crowell, 16 O. G. 405, C. D. (1879) 177; Thomas v. Reese, 17 O. G. 195, C. D. (1879) 335; Bell v. Brooks, 19 O. G. 290, C. D. (1881) 4; DeKando v. Armstrong, 37 App. D. C. 314, 321, 169 O. G. 1185, C. D. (1911) 413; Lorimer v. Erickson, 227 O. G. 1445, 44 App. D. C. 503; Rebuffat v. Crawford, 68 Fed. (2d) 980, 982; Wilson v. Sherts, 81 Fed. (2d) 755, 760.

made accessible to the American public in ways provided by the statutes, they are not within the cognizance of the patent statutes and that such foreign inventions can be made so accessible, in the absence of actual disclosure in this country, only through the disclosure thereof in a foreign patent (R. S. 4886), in a printed publication in this or any foreign country (R. S. 4886), or, in a case falling within the purview of R. S. 4887, in an application filed abroad.

Construing R. S. 4886, it was held in *Bell v. Brooks*, 19 O. G. 290, C. D. (1881) 4, as stated in the syllabus:

> "Testimony in reference to experiments and reduction to practice in foreign countries, whether the invention be that of an American citizen or foreigner, is incompetent and inadmissible, the Revised Statutes of the United States proscribing all other evidence of invention abroad than that derived from patents or printed publications."

It was said by the Commissioner of Patents in *Smith v. Barter*, 7 O. G. 1, C. D. (1875) 5, 7, that to admit evidence of conception and actual reduction to practice in a foreign country would upset "the long established practice of the Office."

The reason for the construction adopted was stated in the case of *Tucker v. Davis*, 2 O. G. 224 thus:

> "A device existing in a foreign country, unless it has been patented or described in a printed publication, so that there is no reasonable probability that it may be known here, is of no benefit to the public of this country. The law proceeds altogether upon the ground that the inventor confers a benefit on the public here, and it specially encourages and protects him for that reason. A foreign inventor, whether a citizen of the United States or not is immaterial, can only

> benefit the public here by publishing his invention here. The original inventor first to produce his invention in this country, either by inventing it here or by bringing it with him from abroad, is the first to have done an act capable of working a benefit to the public here, and the one to be rewarded by a patent. It follows that evidence of any act not coming within the limitation would not be pertinent to an issue upon a question of priority of invention and should not be admitted."

Prior to the Amendment of R. S. 4887, by the Act of March 3, 1903, 32 Stat. 1225, giving to an application, filed in this country within twelve months of the filing in a foreign country of an application for patent for the same invention, the same force and effect as the application in this country would have if filed on the date of filing of the foreign application, the only evidence of invention in a foreign country admissible in the Patent Office and in the Courts of Appeal for the District of Columbia, was that derived from prior issued patents in a foreign country or printed publications in this or any foreign country.

Since the Amendment of R. S. 4887 in 1903, the tribunals of the Patent Office and the Court of Appeals of the District of Columbia have modified the pre-existing rule in accordance with the terms of that Amendment, but only to the extent of permitting a foreign inventor to establish the date of his foreign invention by his foreign application in cases falling strictly within the terms of the Amendment.

Thus, in *Wilson v. Sherts,* 81 Fed. (2d) 755, 760, 761, the Court of Customs and Patent Appeals said:

> "The right of a party to have the benefit of the filing date of a foreign application for a patent as a constructive reduction to practice is purely statutory. Without the benefit of said section 4887, R. S., appel-

lants would not be entitled to consideration of their British provisional application at all. It seems to us that the right of the appellants to the benefit of their activities abroad must be found within the four corners of this statute, and the only right thus granted is the benefit of the filing date of the foreign application."

In suits under R. S. 4915, 35 U. S. C. § 63, the patent statutes have been interpreted in like manner by the inferior courts.[2]

In infringement suits the statutes have been given the same construction in the determination of priority between the foreign inventor plaintiff and a third person who made the same invention in this country which was subsequently patented.[3]

The same construction of the patent statutes has been applied generally by some of the Courts in patent infringement suits.

Thus, in *Ireson v. Pierce*, 39 Fed. 795, 798, Circuit Judge Coit said:

> "Under §§ 4886, 4920, 4923, Rev. St., the *only* evidence that can be used in proof of a foreign invention *for any purpose* is that coming through the channel of a patent or printed publication."

In *Jay v. Weinberg*, 250 Fed. 469, 472, which involved the question of priority of invention coming within the terms of R. S. 4887, as amended in 1903, the Court said:

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[2] Westinghouse Mach. Company v. General Electric Company, 207 Fed. 75, 78.

[3] Electrical Accumulator Co. v. Julien Electric Co., 38 Fed. 117, 128; Brush Electric Co. v. Julien Electric Co., 41 Fed. 679, 686; Electrical Accumulator Co. v. Brush Electric Co., 52 Fed. 130, 134, (C. C. A. 2); Vacuum Engineering Co. v. Dunn, 209 Fed. 219 (C. C. A. 2); Patents Selling & Exporting Co. v. Dunn, 213 Fed. 40 (C. C. A. 2).

"The foreign application date is therefore the effective date of this patent."

The foregoing decisions seem to be in harmony with the broad purpose, object and spirit of the patent statutes as declared in the decisions of this Court.*

In *Gayler v. Wilder*, 10 How. 477, 496, Mr. Chief Justice Taney, speaking for the Court, said:

> ". . . by knowledge and use the legislature meant knowledge and use existing in a manner accessible to the public. If the foreign invention had been printed or patented, it was already given to the world and open to the people of this country, as well as of others, upon reasonable inquiry. They would therefore derive no advantage from the invention here. It would confer no benefit upon the community, and the inventor therefore is not considered to be entitled to the reward. But if the foreign discovery is not patented, nor described in any printed publication, it might be known and used in remote places for ages, and the people of this country be unable to profit by it. The means of obtaining knowledge would not be within their reach; and, as far as their interest is concerned, it would be the same thing as if the improvement had never been discovered. It is the inventor here that brings it to them, and places it in their possession. And as he does this by the effort of his own genius, the law regards him as the first and original inventor, and protects his patent, although the improvement had in fact been invented before, and used by others."

In *Gandy v. Main Belting Co.*, 143 U. S. 578, this Court held that two years public use of the invention abroad was

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* Grant, et al. v. Raymond, 6 Pet. 218, 243; Kendall v. Winsor, 21 How. 322, 327-328; Gayler v. Wilder, 10 How. 477, 496-497; Gandy v. Main Belting Co., 143 U. S. 578.

not a bar to a patent, notwithstanding R. S. 4886 did not then expressly provide that such use, to be a bar, should be "in this country".

Some of the inferior Courts, including the Courts below, however, overlooking, it is believed, that no acts abroad other than patents, printed publications, and patent applications within the purview of R. S. 4887, are within the contemplation of the patent statutes, and disregarding the purpose, object and spirit of those statutes have held, in patent infringement suits based on patents for inventions made in a foreign country, that the patentee may carry back the date of the invention, as against knowledge and use in this country by a non-patentee defendant, to the actual date thereof in the foreign country.[5]

Such construction makes the right of a foreign inventor to carry back the date of his invention to the actual date thereof in a foreign country, turn upon whether his adversary has, or is seeking, a patent monopoly. If he has a patent for an invention made in this country or has applied for a patent for an invention made in this country, the date of the invention abroad may not be carried back of the date of its disclosure in this country, otherwise than by prior foreign patent therefor, by description of the invention in a printed publication, or by the filing of an application for a foreign patent meeting the requirements of R. S. 4887. If, however, the adversary is not seeking, or *has not obtained a patent monopoly* for himself *but is a member of the general public engaged in commercial pro-*

[5] Hanifen v. E. H. Godshalk, 78 Fed. 811; Hanifen v. Price, 96 Fed. 435; Welsbach Light Co. v. American Incandescent Lamp Co., 98 Fed. 613; Badische Anilin & Sode Fabrik v. A. Klipstein & Co., 125 Fed. 543; Claude Neon Lights Co. v. Rainbow Light, 47 Fed. (2d) 345.

duction, the foreign inventor may, *under such decisions,* carry back, by oral testimony, the date of his invention to the actual date of invention in a foreign country. It is difficult to find either in the letter or spirit of the patent statutes a justification for an interpretation that makes possible such distinction to the detriment of the general public, and particularly to those thereof engaged in commercial production, and to the advantage of those who seek or have a patent monopoly.

Under the very terms of R. S. 4886, the question whether an inventor is the *first inventor* is made to turn upon whether the thing invented was known or used in this country before the date of invention to which, *under the statutes,* the inventor is entitled. *That issue does not turn upon whether the thing so known or used in this country is patented, or upon whether an application for a patent therefor has been filed.*

Kendall v. Winsor, 21 How. 322, 328.

It is believed that neither the letter nor the spirit of the patent statutes warrants the construction placed upon them by the decision of the Courts below.

Because of the character of the question involved, the long-existing conflict between the decisions of the Patent Office and the Court of Customs and Patent Appeals on the one hand, and the decisions of inferior Courts, including the Courts below, on the other, as to the true construction of the patent statutes touching the date of an invention made abroad and the question of priority between one who makes an invention abroad and another who uses the same thing in this country, presents a legal bewilderment upon an issue of broader public concern, it is believed, than that which arises when Circuit Courts of Appeals dif-

fer with respect to the construction or validity of a single patent.

It is suggested that the question of the true construction of the patent statutes touching the date of an invention made abroad is one of fundamental importance, one that affects the public generally, and one that should be settled by this Court.

POINT II.

In Holding That United States Patents Are Not Invalidated by Commercial Use by Others in This Country, of the Inventions Patented, for More Than Two Years Before the Actual Filing of the Applications for Such Patents, the Court Below Has Decided a Federal Question in a Way Probably in Conflict With Applicable Decisions of This Court, as Well as of Another Circuit Court of Appeals.

The Courts below found that petitioner began, in June 1921, commercial use of the inventions of the claims found valid and infringed. (R. II, 1192).

Shimadzu's application for patent No. 1,584,150 was filed July 14, 1923. His application for patent No. 1,896,020 was filed April 27, 1926.

The filing date of each application was more than two years after June 1921.

Both R. S. 4886 and R. S. 4887 in express terms constitute a bar to a patent if the invention thereof has been in public use in this country for more than two years prior to the filing of the application for such patent in the United States.

Petitioner's use from June 1921 was a commercial use. It was not experimental. (R. II, 1192). Respondents' rec-

ognizing that petitioner's employees have not been pledged to secrecy, called as a witness in their prima facie case, one of petitioner's former employees, to describe the process and apparatus used by petitioner (R. I, 401). His testimony covered the period beginning in June 1923 and ending in 1930 (R. I, 401). The decision of the Court below is thus probably in conflict, it is believed, with the decisions of this Court in *Egbert v. Lippman*, 104 U. S. 333; *Brush v. Condit*, 132 U. S. 39, 49; and *Manning v. Cape Ann Isinglass & Glue Co.*, 108 U. S. 462.

Such decision of the Court below likewise appears to be in conflict with the decision of the Circuit Court of Appeals for the Eighth Circuit in *Twyman v. Radiant Glass Co.*, 56 Fed. (2d) 119, 121.* In that case the patent was for a mold for glass cylinders. In holding the patent invalid because of defendant's public use of the invention thereof for more than two years prior to the date of plaintiff's application, the Court said:

> "There is nothing in the record to sustain plaintiff's contention that the art of making glass molds was in the experimental stage at the time he entered the field. *For more than two years prior to that time defendant had been using the accused device in the manufacture of these molds commercially* and in sub-

*This decision would be set up as a separate and distinct reason for granting the writ of certiorari upon the ground that the decision of the Court below is in conflict therewith on the same matter were it not for the fact that the District Court in the Twyman case found "that the device manufactured and sold by the appellee was in public use for more than two years prior to the date of appellant's application for patent." (56 Fed. (2d) 120.) By reason of that difference, though apparently without substance, counsel are unwilling to certify that the two cases are in conflict "on the same matter".

stantial numbers for sale to the public. They were being so manufactured *for the purposes of the trade and for profit.* There is nothing to indicate that they were being manufactured for experimental purposes, but, if used mainly for purposes of trade, and incidentally as an experiment, the use would still be a public one."

Point III.

In Holding Valid a United States Patent Granted to One Who Had Made an Invention in a Foreign Country, But Who Withheld and Suppressed It for a Long Period of Time and Did Not File an Application for a United States Patent Therefor Until More Than Two Years After the Thing Subsequently Patented Had Been Brought into Commercial Use by Others in This Country, the Courts Below Decided an Important Question of Federal Law in a Way Probably in Conflict with an Applicable Decision of This Court.

The Courts below found that the invention of Patent No. 1,584,150 was made in Japan in August 1919. (R. II, 1166.)

The Courts below likewise found that, notwithstanding Shimadzu filed applications for Japanese patents in November 1920, he withheld "the really essential steps of the invention for later patenting". (R. II, 1172, 1225.)

Shimadzu did not file his applications for United States patents Nos. 1,584,150 and 1,896,020 until July 14, 1923 and April 27, 1926, respectively. The date on which each of those applications was filed was more than two years after June 1921, the date upon which the Courts below have found that petitioner began its commercial use, by the Hardinge Mill, of Patent 1,584,150 (R. II, 1192).

The Courts below likewise found (R. II, 1172),

"We are not concerned with the motives which prompted him in taking out the '563 patent to confine it to the single step of mechanical removal of the dust from the drum and to withhold the really essential steps of the invention for later patenting. It is sufficient to say that he had the right to do this if he chose."

It is suggested that by so finding, the Courts below decided a Federal question in a way probably in conflict with an applicable decision of this Court. That decision is *Kendall v. Winsor*, 21 How. 322, 328. This Court there said:

"By correct induction from these truths, it follows, that the inventor who designedly, and with the view of applying it indefinitely and exclusively for his own profit, withholds his invention from the public, comes not within the policy or objects of the Constitution or acts of Congress. He does not promote, and, if aided in his design, would impede, the progress of science and the useful arts. And with a very bad grace could he appeal for favor or protection to that society which, if he had not injured, he certainly had neither benefitted nor intended to benefit. Hence, if, during such a concealment, an invention similar to or identical with his own should be made and patented, or brought into use without a patent, the latter could not be inhibited nor restricted, upon proof of its identity with a machine previously invented and withheld and concealed by the inventor from the public. The rights and interests, whether of the public or of individuals, can never be made to yield to schemes of selfishness or cupidity; moreover, that which is once given to or is invested in the public, cannot be recalled nor taken from them."

CONCLUSION.

For the foregoing reasons, it is believed that this Court should be moved to grant the writ of certiorari to the end that the fundamental questions of patent law here involved may be settled by this Court and the judgment of the Court below reversed.

Respectfully submitted,

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October , 1938.

Appendix.

CONTAINING REVISED STATUTES 4886, 4887, 4920 AND 4923

BEING RESPECTIVELY

§§ 31, 32, 69 and 72 of Title 35 U. S. C.

RS4886

"*Section 31. Inventions patentable.* Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, not known or used by others *in this country,* before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor. (R. S. § 4886; Mar. 3, 1897, c. 391, § 1, 29 Stat. 692.)"

RS4887

"§32. *Inventions previously patented abroad.* No person otherwise entitled thereto shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented by the inventor or his legal representatives or assigns in a foreign country, unless the application for said foreign patent was filed more than twelve months, in cases within the provisions of section 31 of this title, and four months in cases of designs, prior to the filing of the application in this country, in which case no patent shall be granted in this country.

"An application for patent for an invention or discovery or for a design filed in this country by any person who has previously regularly filed an application for a patent for the same invention, discovery, or design

in a foreign country which, by treaty, convention, or law, affords similar privileges to citizens of the United States shall have the same force and effect as the same application would have if filed in this country on the date on which the application for patent for the same invention, discovery, or design was first filed in such foreign country, provided the application in this country is filed within twelve months in cases within the provisions of section 31 of this title, and within four months in cases of designs, from the earliest date on which any such foreign application was filed. But no patent shall be granted on an application for patent for an invention or discovery or a design which had been patented or described in a printed publication in this or any foreign country more than two years before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country for more than two years prior to such filing. (R. S. § 4887; Mar. 3, 1897, c. 391, § 3, 29 Stat. 693; Mar. 3, 1903, c. 1019, § 1, 32 Stat. 1225.)"

RS4920

"§ 69. *Pleading and proof in actions for infringement.* In any action for infringement the defendant may plead the general issue, and, having given notice in writing to the plaintiff or his attorney thirty days before, may prove on trial any one or more of the following special matters:

"First. That for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect; or,

"Second. That he had surreptitiously or unjustly obtained the patent for that which was in fact invented

by another, who was using reasonable diligence in adapting and perfecting the same; or,

"Third. That it has been patented or described in some printed publication prior to his supposed invention or discovery thereof, or more than two years prior to his application for a patent therefor; or,

"Fourth. That he was not the original and first inventor or discoverer or* any material and substantial part of the thing patented; or,

"Fifth. That it had been in public use or on sale in this country for more than two years before his application for a patent, or had been abandoned to the public.

"And in notices as to proof of previous invention, knowledge, or use of the thing patented, the defendant shall state the names of the patentees and the dates of their patents, and when granted, and the names and residences of the persons alleged to have invented or to have had the prior knowledge of the thing patented, and where and by whom it had been used; and if any one or more of the special matters alleged shall be found for the defendant, judgment shall be rendered for him with costs. And the like defenses may be pleaded in any suit in equity for relief against an alleged infringement; and proofs of the same may be given upon like notice in the answer of the defendant, and with the like effect. (R. S. § 4920; Mar. 3, 1897, c. 391, § 2, 29 Stat. 692)."

RS4923

"§ 72. *Patent not void for previous use of thing in foreign country.* Whenever it appears that a patentee, at the time of making his application for the patent, believed himself to be the original and first inventor or dis-

* "or" should be "of".

coverer of the thing patented, the same shall not be held to be void on account of the invention or discovery, or any part thereof, having been known or used in a foreign country, before his invention or discovery thereof, if it had not been patented or described in a printed publication. (R. S. § 4923.)'"*

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* It would seem that RS4923 has now become *functus officio* because it had its origin in § 15 of the Patent Act of 1836 (5 Stat. 117), when § 6 of that Act, an antecedent of RS4886, did not contain the words "in this country" after the words "not known or used by others" which were inserted in § 24 of the Patent Act of 1870 (16 Stat. 198). Notwithstanding this Amendment of 1870 to what is now RS4886, § 15 of the Patent Act of 1836 became without substantial change a part of § 62 of the Act of 1870.

RS4923 apparently has not been amended since its incorporation in the Revised Statutes.

Thus it would seem that the words "in this country" in § 24 of the Act of 1870, extended the doctrine of RS4923, which applied to patentees, to everyone without distinction.

FILE COPY

IN THE

Supreme Court of the United States

October Term, 1938.

No. 441.

THE ELECTRIC STORAGE BATTERY CO.,
Petitioner,

v.

GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION,
Respondents.

BRIEF FOR PETITIONER.

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INDEX.

	Page
Opinions of the Courts Below	1
Jurisdiction	2
Statement of the Case	2
Specification of Errors Intended to be Urged	9
Summary of Argument	11
ARGUMENT:	
Point I: Save as provided in RS4887, an invention made abroad does not come within the contemplation or cognizance of the patent statutes of the United States unless and until it has been patented or described in a printed publication here or abroad, or the invention has been communicated and described to some person or persons in this country	13
Point II: If Shimadzu's acts in Japan are within the cognizance of the patent statutes of the United States, he suppressed, concealed and withheld his inventions until long after petitioner had brought into commercial use in this country inventions similar to or identical with his	28
Point III: Petitioner's commercial use in June 1921 of its Hardinge Mill and process was, in law, a public use. Such use was more than two years prior to Shimadzu's application for his patents 1,584,150 and 1,896,020	31
CONCLUSION	36
APPENDIX	1a

TABLE OF CASES CITED.

	Page
Appliance Co. v. Equipment Co., 297 U. S. 387, 392	2
Armstrong Paint & Varnish Works v. Nu-Enamel Corp., No. 51 Oct. Term, 1938	27
Badische Anilin & Sode Fabrik v. A. Klipstein & Co., 15 Fed. 543	24
Bell v. Brooks, 19 O. G. 290	17, 18
Boyce v. Stewart-Warner Speedometer Corp., 220 Fed. 118	26
Brown v. Duchesne, 19 How. 183, 195	22
Brush Elec. Co. v. Julien Elec. Co., 41 Fed. 679	20
Brush v. Condit, 132 U. S. 39, 40	34
Carr v. Davids, 3 O. G. 440	17
Chambers v. Duncan, 9 O. G. 741	17
Chapman v. Wintroath, 252 U. S. 126	30
Chickasha Cotton Oil Co. v. Roden, 66 Fed. (2d) 127	35
Claude Neon Lights Co. v. Rainbow Light, 47 Fed. (2d) 345	24
Corona Co. v. Dovan Corp., 276 U. S. 358	26
Dawson v. Follen, Fed. Cas. 3670	15
DeKando v. Armstrong, 37 App. D. C. 314	17
Douglas v. Cunningham, 294 U. S. 207	2
Egbert v. Lippman, 104 U. S. 333	34
Electrical Accumulator Co. v. Brush Elec. Co., 52 Fed. 130	20
Electrical Accumulator v. Julien Electric Co., 38 Fed. 117	20
Ex Parte Grosselin, 97 O. G. 2977	21, 27
Gandy v. Main Belting Co., 143 U. S. 587	16
Gardiner v. Howell, 2 Cliff. 462, Fed. Cas. No. 5219	2

TABLE OF CASES—Continued.

	Page
Gayler v. Wilder, 10 How. 477	21, 24
Hall v. Shimadzu, 59 F. 2, 225	32
Hanifen v. Godshalk, 78 Fed. 811	24
Hanifen v. Price, 96 Fed. 435	24
Hovey v. Hufeland, 2 O. G. 493	17
Ireson v. Pierce, 39 Fed. 795	21
Jay v. Weinberg, 250 Fed. 469	21
Keller v. Adams-Campbell, 264 U. S. 314	2
Kendall v. Winsor, 21 How. 322	17, 26, 29
Lauder v. Crowell, 16 O. G. 405	17
Loom Co. v. Higgins, 105 U. S. 580	35
Lorimer v. Erickson, 227 O. G. 1445	17
Manning v. Cape Ann Isinglass & Glue Co., 108 U. S. 462	34
Milburn Co. v. Davis etc. Co., 270 U. S. 390	14, 25
N. Y. Life Ins. Co. v. Viglas, 297 U. S. 672	2
Patents Selling & Exporting Co. v. Dunn, 213 Fed. 40	20
Pennock v. Dialogue, 2 Pet. 20	15
Planing Machine Co. v. Keith, 101 U. S. 479	35
Prudence Co. v. Fidelity Co., 297 U. S. 198	2
Rebuffat v. Crawford, 68 Fed. (2d) 980	18
Rifle and Cartridge Co. v. Whitney Arms Co., 118 U. S. 22	30
Roberts v. Graham, 6 Wall. 578	35
Roemer v. Simon, 95 U. S. 214	35
Roschack v. Walker, C. D. 1889, 157	17
Rousseau v. Brown, 104 O. G. 1120	17
Sewell v. Jones, 91 U. S. 171	15
Smith v. Barter, 7 O. G. 1	17, 18
Texas & N. O. R. Co. v. Brotherhood, 281 U. S. 548	4
Thomas v. Reese, 17 O. G. 195	17

TABLE OF CASES—Continued.

	Page
Triplett v. Lowell, 297 U. S. 638	2
Tucker v. Davis, 2 O. G. 224	17, 18
Twyman v. Radiant Glass Co., 56 Fed. (2d) 119	33, 34
Vacuum Engineering Co. v. Dunn, 209 Fed. 219	20
Victor Talking Mach. Co. v. Starr Piano Company, 281 Fed. 60	30
Webster Elec. Co. v. Splitdorf Elec. Co., 264 U. S. 463.	30
Welsbach Light Co. v. Amer. Incandescent Lamp Co., 98 Fed. 613	24
Westinghouse Mach. Co. v. Gen. Elec. Co., 207 Fed. 75.	20
Wilson v. Sherts, 81 Fed. (2d) 755	18, 19
Wirebounds Patents Co. v. Saranac Automatic Mach. Corp., 65 Fed. (2d) 904	30
Woodbridge v. United States, 263 U. S. 50	30

STATUTES AND TEXT BOOKS CITED.

	Page
Judicial Code, Sec. 240(a), 28 U. S. C. § 347(a)	2
Nolan Act, Sec. 6, 35 U. S. C. § 85	4a, 14, 17, 24
Patent Act of 1790, 1 Stat. 109	6a
Patent Act of 1793, 1 Stat. 318	6a
Patent Act of 1836, 5 Stat. 117	6a, 8a, 10a, 15, 16
Patent Act of 1839, 5 Stat. 353	8a
Patent Act (Consolidated) of 1870, 16 Stat. 198,	7a, 8a, 10a, 16, 15
Patent Act of 1897, 29 Stat. 692	7a, 9a
Patent Act of 1903, 32 Stat. 1225	10a, 16, 18, 19, 20, 21
R. S. 4886, 35 U. S. C. § 31	1a, 13, 18, 24, 25, 31
R. S. 4887, 35 U. S. C. § 32	1a, 13, 16, 17, 18, 19, 20, 21, 24, 26, 27, 31
R. S. 4904, 35 U. S. C. A. § 52	2a, 13, 24, 25
R. S. 4915, 35 U. S. C. § 63	20
R. S. 4920, 35 U. S. C. § 69	3a, 13, 24, 25
R. S. 4923, 35 U. S. C. § 72	4a, 13, 24
U. S. C. Title 28, § 347(a), Judicial Code § 240(a)	2
U. S. C. Title 35	
§ 31, RS4886	1a, 13
§ ~~31~~ 32, RS4887	1a, 13
§ 52, RS4904	2a, 13
§ 63, RS4915	20
§ 69, RS4920	3a, 13
§ 72, RS4923	4a, 13
§ 85, Nolan Act, § 6	4a, 14, 17, 24
U. S. Constitution, Art. I, Sec. (8), Cl. 8	17, 21
Robinson on Patents, Vol. I, p. 538	22
Stringham's Outline of Patent Law, p. 193	27
Walker on Patents, Deller's Ed., Vol. II, p. 918	23, 31

IN THE

Supreme Court of the United States.

No. 441. October Term, 1938.

THE ELECTRIC STORAGE BATTERY CO.,

Petitioner,

v.

GENZO SHIMADZU AND NORTHEASTERN ENGINEERING CORPORATION,

Respondents.

Brief for Petitioner.

This is a patent infringement suit, here on certiorari to the Circuit Court of Appeals for the Third Circuit.

OPINIONS OF THE COURTS BELOW.

The opinion of the District Court (R. II, 1162) is reported in 17 Fed. Supp. 42.

Memorandum amending opinion of the District Court after rehearing (R. II, 1189) is not officially reported.

The opinion of the Circuit Court of Appeals (R. II, 1223) is reported in 98 Fed. (2d) 831.

An opinion of the District Court upon defendant's application, with leave of the Circuit Court of Appeals, to take additional evidence after appeal had been perfected, is not

reported in the Federal Reporter, but is reported in 36 USPQ 25.[1]

JURISDICTION.

The date of the judgment or decree of the Court below is August 8, 1938 (R. II, 1226).

Rehearing was denied September 14, 1938 (R. II, 1255).

Petition for certiorari was filed October 27, 1938.

The writ of certiorari was granted December 5, 1938.

The jurisdiction of this Court is invoked under Judicial Code, Sec. 240(a) as amended by the Act of February 13, 1935 (28 USC § 347(a)).

Cases believed to sustain the jurisdiction are:

Keller v. Adams-Campbell, 264 U. S. 314, 318, 319;

Appliance Co. v. Equipment Co., 297 U. S. 387, 392;

Triplett v. Lowell, 297 U. S. 638, 639;

Douglas v. Cunningham, 294 U. S. 207, 209;

Prudence Co. v. Fidelity Co., 297 U. S. 198, 205;

N. Y. Life Ins. Co. v. Viglas, 297 U. S. 672, 676.

STATEMENT OF THE CASE.

The parties plaintiff, respondents here, are Shimadzu, a subject of the Emperor of Japan and a resident of Japan, who is the patentee and owner of the patents alleged to be infringed, and Northeastern Engineering Corporation, exclusive licensee.

Defendant is The Electric Storage Battery Company, the petitioner here.

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[1] That opinion is believed not pertinent to the issues here presented.

Six patents to Shimadzu were sued upon.[2]

The District Court adjudged (R. II, 1192)

Patents	Claims	Decree
1,584,149	1-2	valid and infringed
1,584,150	1-4, 6, 8-13	valid and infringed
1,896,020	10-11	valid and infringed

The remaining claims in issue of these and the other three patents in suit below were adjudged valid but not infringed.[3]

Upon appeal the decree of the District Court was affirmed on the findings and opinion of the District Court (R. II, 1223).

The claims here involved of patents 1,584,149 and 1,584,150 are for a method of producing a fine powder of lead by the abrasion of larger pieces of metallic lead in a dry state in a rotating mill under specified conditions.[4]

The claims of patent 1,896,020 that were held valid and infringed are for apparatus for carrying out the process.

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[2] Patent	Claims	Application Filed	Patent Issued
1,584,149	1-2	Jan. 30, 1922	May 11, 1926
1,584,150	1-4, 6, 8-17	July 14, 1923	May 11, 1926
1,584,151	1-5	Apr. 18, 1924	May 11, 1926
1,584,152	1-2	Apr. 18, 1924	May 11, 1926
1,584,479	1-4	Feb. 20, 1923	May 11, 1926
1,896,020	10-11	Apr. 27, 1926	Jan. 31, 1933

[3] The decree of the Court below, insofar as it adjudges any claims in issue valid but not infringed, is not here for review.

[4] The Courts below found that the process of patent No. 1,584,149 differed from that of patent No. 1,584,150 in that the process of the former is carried out at room temperature and air is introduced into the mill to remove the powder from the mill, while in the latter, the process is carried out at elevated temperatures and air is introduced into the mill for oxidation purposes (R. II, 1166-7).

The product, "lead dust," is used in the manufacture of plates for storage batteries (R. II, 1162).

Petitioner is the manufacturer of the "Exide" batteries. It has been engaged in manufacturing storage batteries in Philadelphia since the latter part of the last century (R. I, 56).

The questions here presented are broadly these:

(1) Whether, under the patent statutes, Shimadzu can, by oral evidence of earlier conception and reduction to practice in Japan, take the date of his inventions back of petitioner's adjudged commercial use thereof at Philadelphia in June, 1921.

(2) Whether the patents in suit, even if otherwise valid, were not invalidated by Shimadzu's suppressing, concealing and withholding his inventions until long after the commercial use by petitioner in Philadelphia of its process and apparatus in June, 1921.

(3) Whether the adjudged commercial use by petitioner at Philadelphia of its process and apparatus in June, 1921 was not, in law, a public use and a bar to patents Nos. 1,584,150 and 1,896,020 because it was more than two years prior to the filing of the applications for these patents.

The questions here presented arise from facts not disputed and from concurrent findings of fact of both Courts below.[5] Those facts are:

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[5] As concurrent findings of facts by the Courts below are not disturbed by this Court unless plainly without support, *Texas & N. O. R. Co. v. Brotherhood*, 281 U. S. 548, 558, and as respondents in their brief in opposition to the petition for certiorari (page 5) take the position that concurrent findings of the two Courts below constitute a deter-

(1) Petitioner began using, early in 1921, in Philadelphia, the process, and Hardinge Mills [6] for carrying out the process, which the Courts below held infringements of the patents in suit (R. II, 1175).

(2) In June, 1921, petitioner began *commercial* production by that process (R. II, 1192).

The Courts below found (R. II, 1192):

> "It is therefore plain that there is no evidence of anything beyond an *experimental* use by the defendant earlier than about the middle of the year 1921 . . . .
>
> "*Commercial production*' (by petitioner) [7] *by the Hardinge Mill with its forced air draft undoubtedly involved the use of plaintiff's patent, and June 1921 may be fixed as the date when that began.*"

(3) The inventions of the patents here in issue were made by Shimadzu in Japan (R. II, 1162).

(4) Shimadzu made no disclosure of his inventions to anyone in the United States before he filed his applications for his United States patents. His inventions were not patented or described in any printed publication in this or any foreign country prior to the filing of his applications for the patents in suit.

(5) The dates upon which Shimadzu filed his applications for the patents here in suit and the dates of their grant, are:

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mination which is not reviewable here, it is believed unnecessary here to review the evidence upon which such findings are based.

[6] Hardinge Mills are described in R. III 4349.

[7] Parenthetical expressions and emphasis throughout brief are counsel's.

Patents	Application Filed	Granted
1,584,149	Jan. 30, 1922	May 11, 1926
1,584,150	July 14, 1923	May 11, 1926
1,896,020	Apr. 27, 1926	Jan. 31, 1933

(6) Shimadzu has no foreign patent for the invention of patent 1,896,020.

The Courts below found (R. II, 1172) that Shimadzu's Japanese patent 60,825 (R. III 21), applied for February 3, 1923,

"corresponds very closely with U. S. '150."

Petitioner contended, but the Courts below denied, (a) that Shimadzu's Japanese patents 41,728 and 42,563 (R. III 20, 22), applied for November 21, 1920 and November 27, 1920, respectively, are for the inventions of the two claims of patent 1,584,149, applied for January 30, 1922; and (b) that his Japanese patent 42,563 is for the same invention as the process claims of patent 1,584,150, applied for July 14, 1923 (R. II, 1172).

(7) To enable Shimadzu to carry the date of his inventions of the patents in suit back of June, 1921, the date upon which petitioner began in Philadelphia the commercial use of its process and apparatus found to infringe, the Courts below permitted respondents, over the objection of petitioner (R. I, 140, 141, 143, 152) to adduce evidence, consisting of oral testimony, drawings and purported copies of alleged notebook entries, that Shimadzu conceived and reduced the inventions to practice in Japan, and the date thereof.

(8) Upon such evidence the Courts below found (R. II, 1166):

> "I fix the date of invention and successful reduction to practice (In Japan) as not later than August 1919. . . ."

and held (R. II, 1178):

> "The plaintiff is undoubtedly entitled to rely for priority upon the date of invention and reduction to practice as found, *regardless of the fact that the invention was made in a foreign country.*"

(9) In denying that Shimadzu's Japanese patent 42,563, applied for November 27, 1920, is for the same invention as the claims of patent 1,584,150, adjudged valid and infringed, the Courts below held (R. II, 1172):

> "For whatever it may be worth it is pretty clear, that the plaintiff himself did not understand that, when he applied for Japanese '563 he was taking out a patent on the same process which appears in U. S. '150 because subsequently in Japan he took another patent, No. 60,825, which corresponds very closely with U. S. '150 and, being within the year does not invalidate it. *We are not concerned with the motives which prompted him,* in taking out the '563 patent, to confine it to a single step of mechanical removal of the dust from the drum, and *to withhold the really essential steps of the invention for later patenting. It is sufficient to say that he had the right to do this if he chose.*"

(10) Among the defenses set up in petitioner's answer were these (R. I, 35):

> "Defendant avers that the claims of said letters patent are invalid and void because the subject matter thereof was, prior to the alleged invention thereof by Shimadzu, and for more than two years prior to his application dates, known to and used by the defendant at Philadelphia, Pennsylvania, and by the Willard Storage Battery Co. at Cleveland, Ohio"

And (top of page 34, R. I):

> ". . . Shimadzu was not the original and first inventor or discoverer of the alleged inventions."

Respondents, in paragraphs 5, 7 and 15 of their bill of complaint (R. I, 8, 10, 14), alleged that the respective inventions were "not in *public* use or on sale in this country more than two years prior" to the dates of the applications for the respective patents. Petitioner, in paragraphs 5, 6 and 10 of its answer (R. I, 28, 29, 30), denied these allegations. Petitioner likewise alleged in its answer, paragraph 18 (R. I, 32) that:

> ". . . it was successfully making, using and selling its product long before it ever heard of Shimadzu or of his alleged inventions and patents,"

(11) In addition to the express findings of both Courts below that petitioner's process and apparatus were experimental during the early part of the year 1921 and that in June 1921 petitioner began commercial production by its process and apparatus, adjudged to infringe respondents' patents—respondents themselves proved that petitioner's process and apparatus were not secret. This respondents did by calling as their voluntary witness to describe petitioner's process and apparatus, one Cooper, a former employee of petitioner and by proving that petitioner's process and apparatus had likewise been described to respondents by one Nagle, another former employee of petitioner (R. I, 401, 412, 423, 420).

(12) The inventions of petitioner's process and apparatus were made wholly independently of Shimadzu and his work (R. II, 1176-1177). The record contains no word of evidence that petitioner acquired any knowledge of the process or apparatus used by petitioner commercially since June 1921, from Shimadzu or his work, either directly or indirectly.

SPECIFICATION OF ERRORS INTENDED TO BE URGED.

The Circuit Court of Appeals for the Third Circuit erred in the instant case:

(1) In holding that "plaintiff is undoubtedly entitled to rely for priority upon the date of invention and reduction to practice as found, regardless of the fact that the invention was made in a foreign country."

(2) In not holding that one who has made an invention in a foreign country and obtained a patent therefor in this country may not, for the purpose of overcoming the defenses of prior knowledge and use in this country and that the patentee is not the first inventor, carry back the date of the invention to the actual time of invention in the foreign country.

(3) In holding that the effective date of the invention of the claims, held valid and infringed, of the patents in suit was not later than August 1919.

(4) In not holding that the patent statutes of the United States proscribe all evidence of invention abroad other than that derived from patents, printed publications, or patent applications within the terms of RS4887.

(5) In not holding that testimony with respect to experiments and reduction of an invention to practice in foreign countries is incompetent and inadmissible under the statutes of the United States, to establish the date of invention of the thing patented or sought to be patented in this country.

(6) In not holding that under the patent statutes, the date of an invention made and first patented in a foreign

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264

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country and thereafter in the United States upon a timely application, is the date of the application for the foreign patent.

(7) In not holding that the claims, adjudged valid and infringed, are invalid because the things patented were known and used by others in this country before the invention or discovery thereof by Shimadzu within the meaning of the patent statutes.

(8) In not holding that the claims, adjudged valid and infringed, are invalid because Shimadzu was not the first inventor.

(9) In not holding that the claims of patents Nos. 1,584,150 and 1,896,020, adjudged valid and infringed, are invalid because the process and apparatus of said claims were in public use in this country for more than two years prior to the actual filing of the applications for said patents in this country.

(10) In not holding that the claims of patents Nos. 1,584,149, 1,584,150 and 1,896,020, adjudged valid and infringed, are invalid because the inventions of said claims were suppressed and concealed by Shimadzu for more than two years after the subject-matter of said claims had been known and used commercially by others in this country.

(11) In holding any of the claims of any of the patents in suit valid and infringed and in granting respondents an injunction and an accounting.

SUMMARY OF ARGUMENT.

THE PATENTS IN SUIT ARE INVALID BECAUSE:

I. Save as provided in RS4887, an invention made abroad does not come within the contemplation or cognizance of the Patent Statutes of the United States unless and until it has been patented or described in a printed publication here or abroad, or the invention has been communicated and described to some person or persons in this country.

A. Under the patent statutes, the earliest dates to which Shimadzu is here entitled for his inventions are long subsequent to the commercial use by defendant of its Hardinge Mill, and process in June 1921.

(1) It follows,

(a) that the inventions were known and used by petitioner in this country before Shimadzu's invention or discovery thereof, within the meaning of the patent statutes, and

(b) that Shimadzu was, within the meaning of the patent statutes, not the first inventor of his alleged inventions:

II. If Shimadzu's acts in Japan are within the cognizance of the patent statutes of the United States, he suppressed, concealed and withheld his inventions until long after petitioner had brought into commercial use in this country inventions similar to or identical with his.

III. Petitioner's commercial use in June 1921 of its Hardinge Mill and process was, in law, a public use. Such use was more than two years prior to Shimadzu's applications for his patents 1,584,150 and 1,896,020.

ARGUMENT.

Point I.

Save As Provided in RS4887, an Invention Made Abroad Does Not Come Within the Contemplation or Cognizance of the Patent Statutes of the United States Unless and Until It Has Been Patented or Described in a Printed Publication Here or Abroad, or the Invention Has Been Communicated and Described to Some Person or Persons in This Country.

Under this caption, the first eight and the eleventh Assignments of Error will be considered together.

The facts pertinent to this issue are believed to be those numbered (1) to (8) inclusive, pages 5 to 6, supra.

Under these facts, it would seem manifest that each of the three patents in suit is invalid unless Shimadzu can, by his acts in Japan, evinced by oral evidence, take the date of his inventions back of June 1921, the date when petitioner's commercial production in this country was begun by the processes and apparatus of the patents in suit.

Thus arises the naked question of law: whether the patent statutes of the United States permit or proscribe evidence of invention abroad, other than patents, printed publications, or patent applications within the terms of RS4887, to ascertain the date of an invention made abroad.

The answer to that question of law turns upon the construction, intent and meaning of the patent statutes of the United States, and particularly RS4886, 4887, 4904, 4920 and 4923 [8] being §§ 31, 32, 52, 69 and 72 respectively, of Title 35 U. S. C., as applied to the determination of the time when,

[8] For convenient reference these sections are set out in an Appendix hereto.

and the acts by which, an inventor who made his invention in a foreign country brings his invention within the cognizance and operation of those statutes.

To the end that petitioner's position may not be misunderstood, petitioner concedes at the very outset that citizens of this country and aliens stand on the same footing under the patent statutes of the United States. One may obtain a patent under the same conditions as the other. Nor is petitioner here questioning the wisdom of Congress in so providing.

But though the patent statutes of the United States make no distinction between the rights thereunder of citizens and aliens, as persons, yet those statutes do place inventive acts performed abroad on an entirely different footing from inventive acts performed in this country.

The Congress itself has expressly recognized that the inventor of an invention made abroad is not entitled to the same rights of priority "in interference *and other proceedings* arising in connection with such invention", as the inventor of an invention made in this country.

In § 6 of the Nolan Act of March 3, 1921, 35 USC § 85, the Congress provided:

> "Where an invention was made by a person while serving abroad, during the World War, with the forces of the United States, civil or military, the inventor thereof shall be entitled, in interference *and other proceedings* arising in connection with such invention, *to the same rights* of priority with respect of such invention *as if the same had been made in the United States.* (Mar. 3, 1921, c. 126, § 6, 41 Stat. 1314)."

In *Milburn Co. v. Davis etc. Co.*, 270 U. S. 390, 402, this Court likewise recognized a statutory difference in policy

between inventions made in this country and those made abroad. It there said:

> "The policy of the statute as to foreign inventions obviously stands on its own footing."

An examination of the statutes reveals that this difference in policy is found with respect to both novelty and priority of invention. Under § 6 of the Patent Act of 1836, 5 Stat. 117, novelty of an invention was defeated if the thing here invented had been known or used anywhere in the world by others prior to the date of such invention. Yet, by § 15 of the Patent Act of 1836, it was provided

> "that whenever it shall satisfactorily appear that the patentee, at the time of making his application for the patent, believed himself to be the first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery or any part thereof having been before known or used in any foreign country, it not appearing that the same or any substantial part thereof had before been patented or described in any printed publication."

Thus, §§ 6 and 15 of the Patent Act of 1836, construed together, provided that while prior use abroad would defeat a patent if such prior use were known,[9] yet if a patent were granted without knowledge of such prior use, the patent could not thereafter be invalidated because of such prior foreign use if the thing here patented had not been previously patented or described in any printed publication.

By § 24 of the Consolidated Patent Act of 1870, 16 Stat. 198, the Congress removed this anomaly by adding the words "in this country" after the words "not known or

[9] Sewell v. Jones, 91 U. S. 171, 179-180; Pennock v. Dialogue, 2 Pet. 20, 22; Dawson v. Follen, Fed. Cas. 3670.

used by others", and thus enacted that foreign knowledge or use by others "not patented, or described in any printed publication" should not deprive an invention here made, of novelty.

Notwithstanding the foregoing amendment to the provisions of § 6 of the Patent Act of 1836, denying to knowledge and use abroad of an invention, not patented or described in any printed publication, the status of a bar to a patent for an invention here made, yet the foregoing quoted provision of § 15 of the Patent Act of 1836 was retained in substance in § 25 of the Consolidated Patent Act of 1870. The result thereof is that since the enactment of the Consolidated Patent Act of 1870, the patent statutes of this country have expressly denied to knowledge and use abroad, even though the use be a public use,[10] any effect, either to bar the granting of a patent or to invalidate a patent already granted.

The inevitable consequence of the inclusion in § 24 of the Consolidated Patent Act of 1870, 16 Stat. 198, after the words "not known or used by others" of the words "in this country", was that novelty and priority of an invention made in this country could not be negatived by knowledge or use, even public use, abroad unless evidenced by patents or printed publications. This remained the law until the Amendment of 1903 to RS4887.

By that Amendment, *certain foreign applications for patents* filed in certain classified countries were added to this exception to the general rule that acts abroad are not within the contemplation of the patent statutes of this country unless such foreign acts are evidenced by patents or printed publications. The statutory denial of recognition

[10] Gandy v. Main belting Co., 143 U. S. 587.

or effectiveness to any acts abroad other than as evidenced by patents, printed publications and patent applications within the purview of RS4887, is general. It is not a denial of recognition and effectiveness of such acts only as against one who seeks or obtains a patent for an invention made in this country. It *is a denial in favor of the general public* as well as in favor of him who seeks or obtains a patent monopoly. In fact, the patent statutes of this country were enacted primarily for the benefit of the general public and only incidentally in favor of an applicant for a patent, or a patentee.[11]

That the patent statutes do not take cognizance of, or give any effect to acts abroad, other than those evinced by patents, printed publications and certain foreign applications for patents within the purview of RS4887, has been recognized not only by the Congress in its enactment of Sec. 6 of the Nolan Act, 35 U. S. C. § 85, but as well by the Patent Office tribunals and the courts.

For far more than half a century, the Patent Office and the Courts of the District of Columbia having appellate jurisdiction over the final decisions of the Patent Office have ruled in interference proceedings in an unbroken line of cases,[12] that unless and until inventions made abroad are

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[11] Kendall v. Winsor, 21 How. 322, 328; U. S. Constitution, Article I, Sec. (8) Clause 8.

[12] Tucker v. Davis, 2 O. G. 224; Hovey v. Hufeland, 2 O. G. 493; Carr v. Davids, 3 O. G. 440, C. D. (1873) 79; Smith v. Barter, 7 O. G. 1, C. D. (1875) 5, 7, 8; Chambers v. Duncan, 9 O. G. 741, C. D. (1876) 82; 10 O. G. 787, C. D. (1876) 223; Lauder v. Crowell, 16 O. G. 405, C. D. (1879) 177; Thomas v. Reese, 17 O. G. 195, C. D. (1879) 335; Bell v. Brooks, 19 O. G. 290, C. D. (1881) 4; Roschack v. Walker, C. D. 1889, 157; 88 O. G. 1333; Rousseau v. Brown, 104 O. G. 1120, 21 App. D. C. 73; DeKando v. Armstrong, 37 App. D. C. 314, 321, 169 O. G. 1185, C. D. (1911) 413; Lorimer v.

made accessible to the American public in ways provided by the statutes, they are not within the cognizance of the patent statutes and that such foreign inventions can be made so accessible, in the absence of actual disclosure in this country, only through the disclosure thereof in a patent (RS4886), in a printed publication in this or any foreign country (RS4886), or, in a case falling within the purview of RS4887, in an application filed abroad.

Prior to the Amendment of 1903 to RS 4887, 32 Stat. 1225, one who made his invention abroad was not permitted, under the statutes, on an issue of priority, to establish the date of his foreign invention even by his foreign application for a patent,—far less by oral testimony.

Construing R. S. 4886, it was held in *Bell v. Brooks,* 19 O. G. 290, C. D. (1881) 4, as stated in the syllabus:

> "Testimony in reference to experiments *and reduction to practice* in foreign countries, whether the invention be that of an American citizen or foreigner, is incompetent and inadmissible, the Revised Statutes of the United States proscribing all other evidence of invention abroad than that derived from patents or printed publications."

As early as 1875 it was said by the Commissioner of Patents in *Smith v. Barter,* 7 O. G. 1, C. D. (1875) 5, 7, that to admit evidence of conception and actual reduction to practice in a foreign country would upset "the long established practice of the Office".

The reason or policy lying behind the statute was stated in the case of *Tucker v. Davis,* 2 O. G. 224, thus:

Erickson, 227 O. G. 1445, 44 App. D. C. 503; Rebuffat v. Crawford, 68 Fed. (2d) 980, 982; Wilson v. Sherts, 81 Fed. (2d) 755, 760.

"A device existing in a foreign country, unless it has been patented or described in a printed publication, so that there is no reasonable probability that it may be known here, is of no benefit to the public of this country. The law proceeds altogether upon the ground that the inventor confers a benefit on the public here, and it specially encourages and protects him for that reason. A foreign inventor, whether a citizen of the United States or not is immaterial, can only benefit the public here by publishing his invention here. The original inventor first to produce his invention in this country, either by inventing it here or by bringing it with him from abroad, is the first to have done an act capable of working a benefit to the public here, and the one to be rewarded by a patent. It follows that evidence of any act not coming within the limitation would not be pertinent to an issue upon a question of priority of invention and should not be admitted."

Since the Amendment of RS4887 in 1903, the tribunals of the Patent Office and the Court of Appeals of the District of Columbia have modified the pre-existing rule in accordance with the terms of that Amendment, but only to the extent of permitting a foreign inventor to establish the date of his foreign invention by his foreign application in cases falling strictly within the terms of the Amendment.

Thus, in *Wilson v. Sherts*, 81 Fed. (2d) 755, 761, 762, the Court of Customs and Patent Appeals said:

"The right of a party to have the benefit of the filing date of a foreign application for a patent as a constructive reduction to practice is purely statutory. Without the benefit of said section 4887, R. S., appellants would not be entitled to consideration of their British provisional application at all. It seems to us that *the right of the appellants to the benefit of their*

***activities abroad must** be found within the four corners of this statute, and the only right thus granted is the benefit of the filing date of the foreign application."*

The Amendment of 1903 to RS4887 is a priority statute conferring rights with respect to inventions made abroad that did not theretofore exist. Manifestly, if prior to the enactment of that Amendment, one who made his invention abroad had been entitled to show by oral testimony or even by his foreign application, the date of his invention abroad, the Amendment of 1903 to RS4887 would have been a work of supererogation.

Moreover that Amendment is not restricted to Patent Office interferences. It applies in whatever proceeding the priority issue arises. It applies in infringement suits upon the issue of priority with the same force that it possesses in interference proceedings in the Patent Office.

In suits under RS4915, 35 USC § 63, the patent statutes have been interpreted in like manner by the inferior courts.[13]

In infringement suits the statutes have been given the same construction in the determination of priority between the foreign inventor plaintiff and a third person who made the same invention in this country which was subsequently patented.[14]

The same construction of the patent statutes has been applied generally by some of the Courts in patent infringement suits.

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[13] Westinghouse Mach. Company v. General Electric Company, 207 Fed. 75, 78.

[14] Electrical Accumulator Co. v. Julien Electric Co., 38 Fed. 117, 128; Brush Electric Co. v. Julien Electric Co., 41 Fed. 679, 686; Electrical Accumulator Co. v. Brush Electric Co., 52 Fed. 130, 134 (C. C. A. 2); Vacuum Engineering Co. v. Dunn, 209 Fed. 219 (C. C. A. 2); Patents Selling & Exporting Co. v. Dunn, 213 Fed. 40 (C. C. A. 2).

Thus, in *Ireson v. Pierce*, 39 Fed. 795, 798, Circuit Judge Colt said:

> "Under §§ 4886, 4920, 4923, Rev. St., the *only* evidence that can be used in proof of a foreign invention *for any purpose* is that coming through the channel of a patent or printed publication."

In *Jay v. Weinberg*, 250 Fed. 469, 472, which involved the question of priority of invention coming within the terms of RS4887, as amended in 1903, the Court said:

> "The foreign application date is therefore the effective date of this patent."

The foregoing decisions are in harmony not only with the letter of the statutes and essential to avoid results glaringly absurd and prejudicial to the rights of the general American public and to the advantage of those having or seeking a patent monopoly, but they are, as well, in harmony with the broad purpose, object and spirit of the patent statutes as provided in Article I, Section 8, Clause 8 of the Federal Constitution [15] and as declared from time to time in the decisions of this Court.

In *Gayler v. Wilder*, 10 How. 477, 497, Mr. Chief Justice Taney, speaking for the Court, said:

> "If the foreign invention had been printed or patented, it was already given to the world and open to the people of this country, as well as of others, upon reasonable inquiry. They would therefore derive no advantage

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[15] Art. 1, Sec. 8, Cl. 8: "To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries;"

The constitutional provision "means progress *in this country.*"

Ex Parte Grosselin, 97 O G 2977, C D (1901) 248.

from the invention here. It would confer no benefit upon the community, and the inventor therefore is not considered to be entitled to the reward. *But if the foreign discovery is not patented, nor described in any printed publication, it might be known and used in remote places for ages, and the people of this country be unable to profit by it. The means of obtaining knowledge would not be within their reach; and, as far as their interest is concerned, it would be the same thing as if the improvement had never been discovered.* It is the inventor *here* that brings it to them, and places it in their possession. And as he does this by the effort of his own genius, *the law regards him* as the first and original inventor, and protects his patent, although the improvement had in fact been invented before, and used by others."

In *Brown v. Duchesne*, 19 How. 183, 195, this Court, speaking of the Constitutional grant and the patent statutes, said:

"The power thus granted is domestic in its character and necessarily confined within the limits of the United States."

. . . . . .

"But these acts of Congress do not, and were not intended to, operate beyond the limits of the United States;"

In *Gardiner v. Howell*, 2 Cliff. 462, Fed. Cas. No. 5219, Clifford J. said:

"The patent laws of the United States afford no protection to inventions beyond or outside of the jurisdiction of the United States."

Robinson on Patents, Vol. I, page 538, § 382 says: [16]

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[16] This statement by Robinson was made prior to the Amendment of 1903 to RS4887.

"Under our law no notice is or can be taken of any inventive act performed abroad until its result is published either in a patent or a printed book. At whatever date, therefore, an unpatented or unpublished foreign invention may have been in fact conceived by its inventor, its conception in the United States takes place only when it becomes an object of intellectual apprehension within the limits of this country. Thus if the inventor, having completed the mental part of his inventive act abroad, comes into the United States, not having already given his invention to the world, the date of his arrival on our shores is the date recognized by our law as the date of his conception; or if he entrusts his secret to an agent, whom he sends into this country upon business connected with the invention, the conception dates from the moment when the agent comes within our boundaries. Hence when a question of priority arises between inventions, one of which was conceived in the United States, while the other had its origin in a foreign country, the rules by which the date of each is ascertained are very different. In the American invention the date of the conception is carried back to the instant when the inventor can be shown to have first clearly apprehended his idea of means; in the foreign invention only to the moment when some person to whom the conception was familiar came within the area of the United States. Where both inventive acts have been performed abroad and neither has been patented, the date of the first application in the United States is held to fix the date of first conception; while if one has been patented, the other not, the former has priority; and if both have been patented the date of the first patent is the date of first conception."

Walker on Patents, Deller's Edition, Vol. II, page 918, § 200, says:

"Where the conception occurred in a foreign country, it receives a conception date contemporaneous with its communication to someone in the United States."

Notwithstanding the provisions of RS4886, 4887, 4904, 4920, 4923, § 6 of the Nolan Act, 35 USC § 85, and the foregoing decisions, some of the inferior courts including the Courts below have held, in patent infringement suits, based on patents for inventions made in a foreign country, that the patentee may carry back the date of the invention of the patent in suit, as against knowledge and use in this country by a non-patentee defendant, to the actual date thereof in the foreign country.[17] In so holding, the inferior courts have failed, it is believed, to construe the several sections of the patent acts in their entirety and as a whole (*Gayler v. Wilder,* 10 How. 477, 496), and to appreciate not only the broad purpose, object and spirit of the patent statutes, but as well the true intent and meaning thereof as expressed in those statutes themselves and in the decisions of the Courts.[18]

It seems likewise clear that such courts have also overlooked that a patent infringement suit, in which the defendant pleads, inter alia, as here, that the patentee of the patent in suit is not the first inventor, raises the same issue of priority of invention as does an interference proceeding in the Patent Office under RS4904; and that one may be an inventor though not a patentee or an applicant for a patent.

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[17] Hanifen v. E. H. Godshalk, 78 Fed. 811; Hanifen v. Price, 96 Fed. 435; Welsbach Light Co. v. American Incandescent Lamp Co., 98 Fed. 613; Badische Anilin & Sode Fabrik v. A. Klipstein & Co., 125 Fed. 543; Claude Neon Lights Co. v. Rainbow Light, 47 Fed. (2d) 345.

[18] Indeed, the express recognition in RS4886 and RS4923 of patents and printed publications and, in RS4887, of foreign applications for patents coming within the purview of that statute, as evidence of inventions made abroad, constitutes, under settled principles of law, a statutory denial of the right to establish such foreign inventions by any other evidence.

Again under RS4886, an inventor is one who "may", by reason of his compliance with the conditions prescribed by that statute, obtain a patent for his invention. To obtain a patent, the applicant must be an inventor. Neither his application for a patent nor the grant of a patent to him, makes him an inventor.

The proceeding in the patent office in an interference is, in the terms of the statute, RS4904, one "to determine the question of priority of invention".

RS4920 provides, inter alia,

> "*In any action for infringement,* the defendant, . . . may prove on trial . . .
>
> "Fourth. That he (the patentee) was not the original and first inventor or discoverer of any material and substantial part of the thing patented;".

In the case at bar, petitioner pleaded (R. I, 34, at top)

> ". . . Shimadzu was not the original and first inventor or discoverer of the alleged inventions."

Under such an issue, defendant may show that the patentee was not the first inventor, even though it is not made to appear who did invent the thing patented.

In *Milburn Co. v. Davis etc. Co.*, 270 U. S. 390, 401, this Court said:

> "It is not necessary to show who did invent the thing in order to show that Whitford (the patentee) did not."

Manifestly, if the patentee of the subject matter of the claims of the patent sued upon in an infringement suit is an inventor, anyone else who independently conceives the same thing and reduces it to practice is likewise an inventor,

regardless of whether the latter does or does not obtain, or even apply for, a patent therefor.[19]

This principle was stated in *Boyce v. Stewart-Warner Speedometer Corp.*, 220 Fed. 118, 124 (CCA2) thus:

> "And if prior invention is shown to have existed and been in use, it is clearly of no consequence whether it was patented or not."

The decisions of the Courts below make the right of a foreign inventor to carry back the date of his invention to the actual date thereof in a foreign country, turn upon whether his adversary has, or is seeking, a patent monopoly. If his adversary has a patent for an invention made in this country or has applied for a patent for an invention made in this country, the date of the invention abroad may *not* be carried back of the date of its disclosure in this country, otherwise than by prior patent therefor, by description of the invention in a printed publication, or by the filing of an application for a foreign patent meeting the requirements of RS4887. If, however, his adversary is not seeking, or *has not obtained a patent monopoly* for himself *but is a member of the general public engaged in commercial production,* the foreign inventor may, *under such decisions,* carry back, by oral testimony, the date of his invention to the actual date of invention in a foreign country.

The evil consequences of such a result are both obvious and serious. Under such construction domestic inventors, especially those engaged in commercial enterprises *must* apply for and obtain patents for their every invention in order that their factories and plants, in the operation of which the use of such invention is essential, be not closed

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[19] Kendall v. Winsor, 21 How. 322, 328; Corona Co. v. Dovan Corp., 276 U. S. 358, 382.

by an injunction issuing in an infringement suit based upon a patent for the same invention made abroad, which patent could not have been obtained had the domestic inventor applied for a patent for his invention.

Indeed, under these decisions, a domestic inventor could not donate or abandon his invention to the public with any assurance that the public might not be enjoined from using it because of a later patent for an invention made abroad, which patent could not have been obtained, had the American inventor sought and obtained a patent monopoly for his invention.[20]

This Court has long recognized that the construction of statutes, to avoid results glaringly absurd, is one of its judicial functions.[21]

As is well said in Stringham's *Outline of Patent Law*, 1937, page 193,

> "Under any statute, the law ought not to be more favorable to one asserting rig. to monopoly against the public, than it is to one asserting right to a monopoly as against a rival claimant to the monopoly. The notion of two kinds of patentable 'new' seems utterly unwarranted."

Because the patent statutes recognize inventive acts, knowledge or use abroad, *only* when evinced by patents, printed publications or applications for patents within the purview of RS4887, the earliest date to which Shimadzu is here entitled for his alleged inventions is long subsequent to the commercial use by petitioner of its Hardinge Mill and process at Philadelphia in June, 1921.

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[20] Ex Parte Grosselein, 97 O. G. 2977, C. D. (1901) 248.

[21] Armstrong Paint & Varnish Works v. Nu-Enamel Corp., 51 October Term, 1938. Opinion filed December 5, 1938, and cases there cited.

It follows:

(a) That the alleged inventions of the patents in suit are wanting in novelty because of knowledge and use thereof by the petitioner in this country before Shimadzu's invention or discovery thereof within the meaning of the patent statutes, and

(b) that Shimadzu was not, within the meaning of those statutes, the first inventor of his alleged inventions.

The patents in suit are hence invalid.

Point II.

If Shimadzu's Acts in Japan Are Within the Cognizance of the Patent Statutes of the United States, He Suppressed, Concealed and Withheld His Inventions Until Long After Petitioner Had Brought Into Commercial Use in This Country Inventions Similar to or Identical With His.

Under this caption, Assignments of Error Nos. 10 and 11 are considered.

The Courts below found that the invention of patent 1,584,150 was made in Japan in August, 1919 (R. II, 1166). It is clear that the Courts below intended this date to apply to the inventions of patents 1,584,149 and 1,896,020, as well (R. II, 1188).

The Courts below likewise found that Shimadzu, in and prior to November, 1920, filed applications for Japanese patents (R. II, 1168), and held (R. II, 1172),

> "We are not concerned with the motives which prompted him in taking out the '563 patent (applied for in Japan November 27, 1920) to confine it to the single step of mechanical removal of dust from the

drum and to *withhold the really essential steps of the invention for later patenting*. It is sufficient to say that he had a right to do this if he chose."

Shimadzu did not file his applications for United States patents 1,584,150 and 1,896,020 until July 14, 1923, and April 27, 1926, respectively. The date on which each of these applications was filed was more than two years after June, 1921, the date upon which the Courts below found that petitioner began its commercial use in Philadelphia, by the Hardinge Mill, of the inventions of those patents (R. II, 1192). Indeed, Shimadzu's application for his patent 1,584,149 was not filed until January 30, 1922, many months after petitioner's process which was held by the Courts below to infringe that patent, was in commercial use.

Should the acts of Shimadzu in Japan be found of any avail to respondents in fixing the date of his inventions, it becomes manifest that after his inventions were complete in August, 1919, he deliberately suppressed and withheld his inventions from the people of this country until long after inventions similar to or identical with his own, had been brought into commercial use in this country by petitioner.

Under such circumstances, it is believed that his invention must be deemed to have been abandoned and that this view is supported by decisions of this Court.

In *Kendall v. Winsor*, 21 How. 322, 328, this Court said:

> "By correct induction from these truths, it follows, that the inventor who designedly, and with the view of applying it indefinitely and exclusively for his own profit, withholds his invention from the public, comes not within the policy or objects of the Constitution or acts of Congress. He does not promote, and, if aided in his design, would impede, the progress of science and

the useful arts. And with a very bad grace could he appeal for favor or protection to that society which, if he had not injured, he certainly had neither benefitted nor intended to benefit. Hence, if, during such a concealment, an invention similar to or identical with his own should be made and patented, *or brought into use without a patent,* the latter could not be inhibited nor restricted, upon proof of its identity with a machine previously invented and withheld and concealed by the inventor from the public. The rights and interest, whether of the public or of individuals, can never be made to yield to schemes of selfishness or cupidity; moreover, that which is once given to or is invested in the public, cannot be recalled nor taken from them."

In *Wirebounds Patents Co. v. Saranac Automatic Mach. Corp.,* 65 Fed. (2d) 904, 906, the CCA6, after discussing the cases of *Webster Elec. Co. v. Splitdorf Elec. Co.,* 264 U. S. 463, *Chapman v. Wintroath,* 252 U. S. 126, and *Woodbridge v. United States,* 263 U. S. 50, held:

"The rationale of these three cases is that if the inventor, intentionally or by reason of culpable neglect, be guilty of action which unduly postpones the time when the public would be entitled to the free use of the invention, and thus defeats the policy of the patent law, the right to a patent will be lost."

In *Victor Talking Mach. Co. v. Starr Piano Company,* 281 Fed. 60, 66, the CCA2 said:

". . . Johnson for years relied upon keeping his process secret. Such construction was a clear abandonment under the decisions."

In *Rifle and Cartridge Co. v. Whitney Arms Co.,* 118 U. S. 22, 24-25, this Court said:

"Such abandonment may be proved either by express declarations of an intention to abandon or by conduct inconsistent with any other conclusion."

As Shimadzu was filing applications for patents in Japan and elsewhere after August, 1919, but delayed filing any application anywhere for the inventions of the patents here in suit until long after the same or like inventions had gone into commercial use in this country, it would seem manifest under the foregoing authorities that the inventions of the patents in suit and each of them must be deemed to have been concealed, suppressed or abandoned and that those patents must therefore be adjudged invalid.

Point III.

Petitioner's Commercial Use in June, 1921, of Its Hardinge Mill and Process Was, in Law, a Public Use. Such Use Was More Than Two Years Prior to Shimadzu's Applications for His Patents 1,584,150 and 1,896,020.

Under this caption, Assignments of Error Nos. 9 and 11 are considered.

Under Point I, we believe that we have shown that the patents in suit are wanting in novelty. *Walker on Patents*, Deller's Edition, pages 261-2, says:

> "Novelty is negatived by prior knowledge and use in this country, by even a single person, of the thing patented. . . . This rule applies even to cases where that knowledge and use were purposely kept secret. . . . And it applies no matter whether or not the prior structure was used."

Under this Point, it is our purpose to establish that the patents in suit, 1,584,150 and 1,896,020, are likewise invalid because of the statutory bar of both RS4886 and RS4887, of public use in this country for more than two years prior to the *filing of the applications* in this country for those patents. The Courts below found (R. II, 1192):

> "It is therefore plain that there is no evidence of anything beyond an experimental use by the defendant earlier than about the middle of the year 1921 . . . *Commercial production* (by petitioner) by the Hardinge Mill with its forced air draft undoubtedly involved the use of the plaintiff's patent, and *June 1921 may be fixed as the date when that began.*" [22]

It is manifest from the foregoing finding of the Courts below that petitioner's production in June, 1921, was commercial and in contrast with the experimental use of the inventions earlier in the year 1921.

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[22] The Hardinge Mill was installed and operated by petitioner under the direction of Mr. C. A. Hall. Later Mr. Hall applied for a patent for the apparatus described and claimed in patent to him No. 1,675,345. (R. III, 39 .) Hall likewise applied for and obtained a patent No. 1,888,823 for a process and a product. (R. III, 44 .) While the last mentioned application was pending, Shimadzu's patent 1,584,150 issued. Hall then added certain claims thereof to his application. An interference, No. 54,798, was declared. The counts not involving lead suboxide were held unpatentable by the Examiner of Interferences and were dropped from the interference.

The Court of Customs and Patent Appeals held (Hall v. Shimadzu, 59 Fed. (2d) 225) that "the production of suboxide of lead is the very heart of each of the counts where the phrase under consideration occurs and this phrase is necessary 'to give life and meaning and vitality' to the counts, . . .": that in Hall's specification, as originally filed, "the words 'suboxide of lead' are nowhere found"; and that Hall's specification, as originally filed "does not warrant claims corresponding to the (lead suboxide) counts here in issue; . . . ."

Consequently, Shimadzu was awarded priority on the counts in issue and Hall's patents issued without claims in the language of the counts.

The Courts below found (R. II, 1185) that

> "He (Shimadzu) has not established the fact that suboxide is to be found in the defendant's (petitioner's) product . . ."

Shimadzu's application for patent 1,584,150 was filed July 14, 1923. His application for patent 1,896,020 was filed April 27, 1926.

The filing date of each application was therefore more than two years after June, 1921.

Under the foregoing finding of the Courts below, petitioner's use from June, 1921, was a commercial use. It was not experimental (R. II, 1192).

There is no evidence, moreover, that such use was secret. On the contrary, respondents themselves showed that it was available to the public in the minutest detail. For respondents without objection by petitioner, adduced, by the testimony of one of petitioner's former employees (Cooper) evidence to prove the precise process and apparatus that had been used by petitioner (R. I, 401, 412). Respondents likewise proved that petitioner's process and apparatus had been described and explained to them by another former employee (Nagle) of petitioner (R. I, 420, 423).

Under such facts established by the respondents themselves, respondents are precluded and barred from now asserting that petitioner's use of its process and apparatus was secret and not available to the public.

In fact, the Circuit Court of Appeals for the Eighth Circuit in *Twyman v. Radiant Glass Co.*, 56 Fed. (2d) 119, 121, held, as we understand that decision, that commercial use in the absence of countervailing evidence, is a public use. In that case, the patent was for a mold for glass cylinders. In holding the patent for the mold invalid because of defendant's use of the mold in the manufacture of its product for purposes of trade for more than two years prior to the date of the plaintiff's application, the Court said:

> "There is nothing in the record to sustain plaintiff's contention that the art of making glass molds was in the experimental stage at the time he entered the field. *For more than two years prior to that time, defendant had been using the accused device in the manufacture of these molds commercially* and in substantial numbers for sale to the public. They were being so manufactured *for the purposes of the trade and for profit.* There is nothing to indicate that they were being manufactured for experimental purposes, but, if used mainly for purposes of trade, and incidentally as an experiment, *the use would still be a public one.*"

This conclusion of the court in the *Twyman* case finds support, it is believed, in the decisions of this Court in *Egbert v. Lippman,* 104 U. S. 333, *Brush v. Condit,* 132 U. S. 39, 40, and *Manning v. Cape Ann Isinglass & Glue Co.,* 108 U. S. 462.

In their brief in opposition to the petition for a writ of certiorari in this case, respondents took the position that petitioner had not set up in its pleading the defense of two years' public use. Respondents are mistaken.

Among the defenses set up in petitioner's answer were these (R. I, 35):

> "Defendant avers that the claims of said letters patent are invalid and void because the subject matter thereof was, prior to the alleged invention thereof by Shimadzu, and for more than two years prior to his application dates, known to and used by the defendant at Philadelphia, Pennsylvania, and by the Willard Storage Battery Co. at Cleveland, Ohio."

Respondent's, in paragraphs 5, 7 and 15 of their bill of complaint, alleged that the respective inventions of patents 1,584,150, 1,584,149 and 1,896,020 were "not in *public* use or on sale in this country more than two years prior" to

the dates of the applications for these respective patents. (R. I, 810, 14). Petitioner, in paragraphs 5, 6 and 10 of its answer, denied those allegations. (R. I, 28, 29, 30.) Petitioner likewise alleged in its answer, paragraph 18 (R. I, 32) that:

> ". . . it was successfully making, using and selling its product long before it ever heard of Shimadzu or of his alleged inventions and patents."

Moreover, respondents did not object to petitioner's answer on the ground of inadequacy or object to any testimony offered by petitioner that its two years' use of its process and apparatus prior to the filing date of Shimadzu's applications for patents 1,584,150 and 1,896,020, was a public use. Under the decisions of this and other Courts, respondents' failure so to do must be deemed a waiver of their right now to object upon that ground.

Roemer v. Simon, 95 U. S. 214, 220.
Loom Co. v. Higgins, 105 U. S. 580, 596.
Planing Machine Co. v. Keith, 101 U. S. 479, 492, 493.
Roberts v Graham, 6 Wall. 578, 581.
Chickasha Cotton Oil Co. v. Roden, 66 F. (2d) 127 (C. C. A. 10).

In *Roberts v. Graham*, 6 Wall. 578, 581, this Court expressed the general rule applicable in such cases thus:

> "The objection of variance not taken at the trial, cannot avail the defendant as an error in the higher court, if it could have been obviated in the court below; . . .."

In *Roemer v. Simon*, 95 U. S. 214, 220, respondents pleaded prior knowledge and use by certain persons desig-

nated in the answer. Two witnesses not so named were examined upon that subject by respondents without objection. Upon these facts, the Court said:

> "Previous notice of the examination of those two witnesses, it seems, was not given; but the presiding justice states that, if seasonable objection had been made, the evidence would have been excluded. None such was made; and it is well-settled law that the failure to interpose any such objection before the final hearing is a waiver of the required notice in an equity suit. *Brown v. Hall,* 6 Blatch. 405."

The conclusion, with or without respondents' own acts in establishing that petitioner's process has at all times been available to the public, is, it is believed, inevitable that petitioner's use in June 1921 was a public use and a statutory bar to patents 1,584,150 and 1,896,020.

CONCLUSION.

For the foregoing reasons, it is believed that each and all of the patents, 1,584,149, 1,584,150 and 1,896,020, here in suit, are invalid and should be so adjudged and that the decree of the Court below should be reversed with directions to dismiss the bill of complaint.

January , 1939.

Respectfully submitted,

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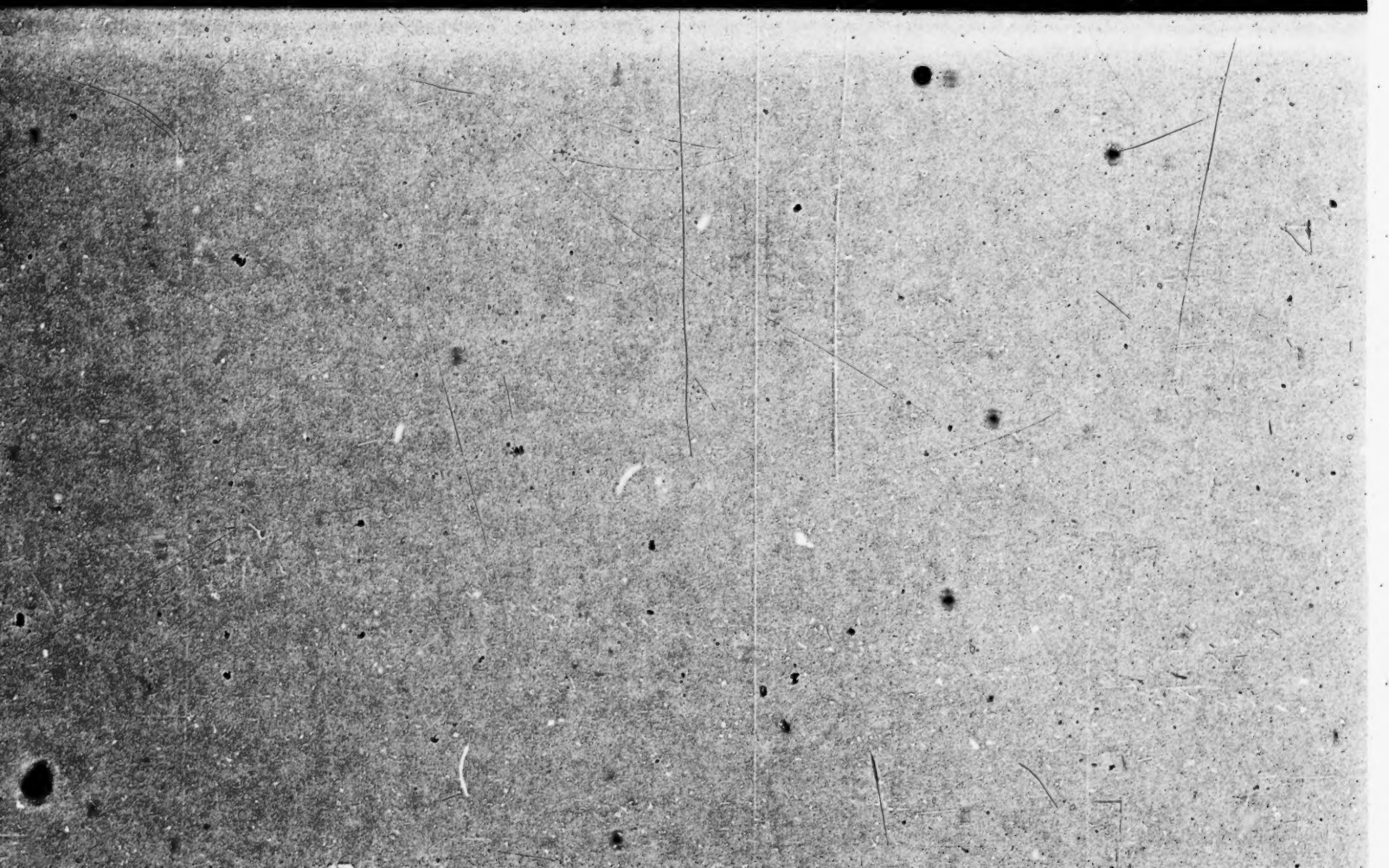
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APPENDIX.

CONTAINING REVISED STATUTES 4886, 4887, 4904, 4920, 4923 AND § 6 OF THE NOLAN ACT, BEING RESPECTIVELY

§§ 31, 32, 52, 69, 72 and 85 of Title 35 U. S. C.

TOGETHER WITH THE STATUTORY HISTORY OF R. S. 4886, 4887 and 4923.



RS4886.

"*Section 31. Inventions patentable.* Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, not known or used by others *in this country*,[1] before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, or more than two years prior to his application, and not in public use or on sale *in this country*[2] for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor. (R. S. § 4886; Mar. 3, 1897, c. 391, § 1, 29 Stat. 692.)"

RS4887.

"§ *32. Inventions previously patented abroad.* No person otherwise entitled thereto shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented by the inventor or his legal representatives or assigns in a foreign country, unless the application for said foreign patent was filed more than twelve months, in cases within the provisions of section 31 of this title, and four months in cases of designs, prior to the filing of the application in this country, in which case no patent shall be granted in this country.

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[1] Inserted by amendment of 1870 (16 Stat. 198).

[2] Inserted by amendment of 1897 (29 Stat. 692); but prior thereto in Gandy v. Main Belting Company, 143 U. S. 587, decided in 1892, this Court construed the statute as if those words had then been included therein.

[3] "An application for patent for an invention or discovery or for a design filed in this country by any person who has previously regularly filed an application for a patent for the same invention, discovery, or design in a foreign country which, by treaty, convention, or law, affords similar privileges to citizens of the United States shall have the same force and effect as the same application would have if filed in this country on the date on which the application for patent for the same invention, discovery, or design was first filed in such foreign country, provided the application in this country is filed within twelve months in cases within the provisions of section 31 of this title, and within four months in cases of designs, from the earliest date on which any such foreign application was filed. But no patent shall be granted on an application for patent for an invention or discovery or a design which had been patented or described in a printed publication in this or any foreign country more than two years before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country for more than two years prior to such filing. (R. S. § 4887; Mar. 3, 1897, c. 391, § 3, 29 Stat. 693; Mar. 3, 1903, c. 1019, § 1, 32 Stat. 1225.)"

RS4904.

"§ 52. *Interferences; determination of priority; issue of patent.* Whenever an application is made for a patent which, in the opinion of the commissioner, would interfere with any pending application, or with any unexpired patent, he shall give notice thereof to the applicants, or applicant and patentee, as the case may be, and shall direct the primary examiner to proceed to determine *the question of priority of invention.* And

[3] The whole of this paragraph had its origin in the amendment of 1903 (32 Stat. 1225).

the commissioner may issue a patent to the party who is adjudged the prior inventor, unless the adverse party appeals from the decision of the primary examiner, or of the board of examiners in chief, as the case may be, within such time, not less than twenty days, as the commissioner shall prescribe. (R. S. § 4904.)"

RS4920.

"§ 69. *Pleading and proof in actions for infringement.* In any action for infringement the defendant may plead the general issue, and, having given notice in writing to the plaintiff or his attorney thirty days before, may prove on trial any one or more of the following special matters:

"First. That for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect; or,

"Second. That he had surreptitiously or unjustly obtained the patent for that which was in fact invented by another, who was using reasonable diligence in adapting and perfecting the same; or,

"Third. That it has been patented or described in some printed publication prior to his supposed invention or discovery thereof, or more than two years prior to his application for a patent therefor; or,

"Fourth. That he was not the original and first inventor or discoverer or * any material and substantial part of the thing patented; or,

"Fifth. That it had been in public use or on sale in this country for more than two years before his ap-

* "or" should be "of".

plication for a patent, or had been abandoned to the public.

"And in notices as to proof of previous invention, knowledge, or use of the thing patented, the defendant shall state the names of the patentees and the dates of their patents; and when granted, and the names and residences of the persons alleged to have invented or to have had the prior knowledge of the thing patented, and where and by whom it had been used; and if any one or more of the special matters alleged shall be found for the defendant, judgment shall be rendered for him with costs. And the like defenses may be pleaded in any suit in equity for relief against an alleged infringement; and proofs of the same may be given upon like notice in the answer of the defendant, and with the like effect. (R. S. § 4920; Mar. 3, 1897, c. 391, § 2, 29 Stat. 692)."

RS4923.

"§ 72. *Patent not void for previous use of thing in foreign country.* Whenever it appears that a patentee, at the time of making his application for the patent, believed himself to be the original and first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery, or any part thereof, having been known or used in a foreign country, before his invention or discovery thereof, if it had not been patented or described in a printed publication. (R. S. § 4923.)"

§ 6 OF THE NOLAN ACT.

"§ 85. *Rights as to inventions made while serving abroad with United States forces during World War.* Where an invention was made by a person while serving abroad, during the World War, with the forces of the United States, civil or military, the inventor

thereof shall be entitled, in interference and other proceedings arising in connection with such invention, to the same rights of priority with respect of such invention as if the same had been made in the United States. (Mar. 3, 1921, c. 126, § 6, 41 Stat. 1314.)"

STATUTORY HISTORY OF R. S. 4886.

The Patent Act of 1790 (1 Stat. 109), provided in § 1 thereof for the grant of Letters Patent,

> ". . . : upon the petition of any person or persons . . . setting forth that he, she, or they hath or have invented or discovered any useful art, manufacture, engine, machine, or device, or any improvement therein not before known or used, . . ."

The Patent Act of 1790 was repealed by the Patent Act of 1793 (1 Stat. 318), which in § 1 provided:

> "That when any person or persons, being a citizen or citizens of the United States, shall allege that he or they have invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement on any art, machine, manufacture, or composition of matter, not known or used before the application, and shall present a petition to the Secretary of State, signifying a desire of obtaining an exclusive property in the same, and praying that a patent may be granted therefor, it shall and may be lawful for the said Secretary of State to cause Letters Patent to be made out in the name of the United States, . . ."

In 1836 this act was replaced by the Patent Act of that year (5 Stat. 117), § 6 of which provided:

> "That any person or persons, having discovered or invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement on any art, machine, manufacture, or composition of matter, not known or used by others before his or their discovery or invention thereof, and not, at the time of his application for a patent, in public use or on sale, with his consent or allowance, as

the inventor or discoverer; and shall desire to obtain an exclusive property therein, may make application, in writing, to the Commissioner of Patents, expressing such desire, and the Commissioner, on due proceedings had, may grant a patent therefor."

The Patent Act of 1836 in turn was repealed by the Consolidated Patent Act of 1870 (16 Stat. 198). § 24 of the latter Act provided:

"That any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereof, not known or used by others in this country, and not patented, or described in any printed publication in this or any foreign country, before his invention or discovery thereof, and not in public use or on sale for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the duty required by law, and other due proceedings had, obtain a patent therefor."

Upon the enactment of the Revised Statutes in 1874, § 24 of the Consolidated Patent Act of 1870 became, without change, R. S. 4886.

In 1897 R. S. 4886 was amended (29 Stat. 692) to read thus:

"Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, un-

less the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor."

The amendment of R. S. 4886 by the Act of May 23, 1930 (46 Stat. 376) is not here pertinent.

STATUTORY HISTORY OF R. S. 4887.

R. S. 4887 had its origin in § 8 of the Patent Act of 1836, which provided in part as follows:

> "But nothing in this act contained shall be construed to deprive an original and true inventor of a right to a patent for his invention, by reason of his having previously taken out Letters Patent therefor in a foreign country, and the same having been published, at any time within six months next preceding the filing of his specification and drawings."

By an amendment contained in § 6 of the Patent Act of 1839 (5 Stat. 353), the foregoing provision of the Patent Act of 1836 was changed to read:

> "That no person shall be debarred from receiving a patent for any invention or discovery, as provided in the act approved on the fourth day of July, one thousand eight hundred and thirty-six, to which this is additional, by reason of the same having been patented in a foreign country more than six months prior to his application: *Provided,* That the same shall not have been introduced into public and common use in the United States, prior to the application for such patent: *And provided also,* That in all cases every such patent shall be limited to the term of fourteen years from the date or publication of such foreign Letters Patent."

By § 25 of the Consolidated Patent Act of 1870 the provision was again changed to read:

"That no person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid, by reason of its having been first patented or caused to be patented in a foreign country: *Provided*, The same shall not have been introduced into public use in the United States for more than two years prior to the application, and that the patent shall expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term; but in no case shall it be in force more than seventeen years."

In 1874 this Section became, with certain modifications, § RS4887 of the Revised Statutes enacted in that year, as follows:

"No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid, by reason of its having been first patented or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States for more than two years prior to the application. But every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force more than seventeen years."

Again, in the Patent Act of 1897, the statute was amended to read thus:

"No person otherwise entitled thereto shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid, by reason of its having been first patented or caused to be patented by the inventor or his legal representatives or assigns in a foreign country, unless the application

for said foreign patent was filed more than seven months prior to the filing of the application in this country, in which case no patent shall be granted in this country."

Finally, by the amendment of 1903, (32 Stat. 1225) R. S. 4887 was given its present form, which it has since retained, save for the extension, by the amendment of June 19, 1936 (49 Stat. 1529), of the convention period in cases of designs from four to six months.

STATUTORY HISTORY OF R. S. 4923.

R. S. 4923 first appears as § 16 of the Patent Act of 1836, which provided:

> "That whenever it shall satisfactorily appear that the patentee, at the time of making his application for the patent, believed himself to be the first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery or any part thereof having been before known or used in any foreign country, it not appearing that the same or any substantial part thereof had before been patented or described in any printed publication."

With slight modifications in terminology, not affecting the substance, § 15 of the Patent Act of 1836 was reenacted as § 62 of the Consolidated Patent Act of 1870, which read thus:

> "That whenever it shall appear that the patentee, at the time of making his application for the patent, believed himself to be the original and first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery, or any part thereof, having been known or used in a foreign country, before his invention or discovery thereof, if it had not been patented or described in a printed publication."

In 1874 §62 of the Consolidated Patent Act of 1870, beginning with the words "Whenever it appears that a patentee", instead of "That whenever it shall appear that the patentee", became § 4923 of the Revised Statutes. The statute has not since been changed.[1]

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[1] At the time when this statute was first enacted as § 15 of the Patent Act of 1836, it served as an express limitation, in favor of certain patentees, upon the right of an adversary to defeat a patent by proof of prior unpatented and unpublished knowledge and use abroad which, by § 6 of that Act were made available to defeat the grant of a patent. In 1870, however, the words "in this country" were inserted in § 24 of the Patent Act of 1870 after the words "not known or used by others". Thus, it would seem that the words "in this country" in § 24 of the Patent Act of 1870, and in R. S. 4886 and all subsequent revisions thereof, extended the policy and effect of R. S. 4923, which applies to patentees only, to everyone without distinction, and that R. S. 4923 is, therefore, functus officio.

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IN THE

Supreme Court of the United States

October Term, 1938.

No. 441.

THE ELECTRIC STORAGE BATTERY COMPANY,
Petitioner,

v.

GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION,
Respondents.

REPLY BRIEF FOR PETITIONER.

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INDEX.

Page

Point I: Save as provided in RS4887, an invention made abroad does not come within the contemplation or cognizance of the patent statutes of the United States unless and until it has been patented or described in a printed publication here or abroad, or the invention has been communicated and described to some person or persons in this country..... 1

Point II: If Shimadzu's acts in Japan are within the cognizance of the patent statutes of the United States, he suppressed, concealed and withheld his inventions until long after petitioner had brought into commercial use in this country inventions similar to or identical with his 10

Point III: Petitioner's commercial use in June 1921 of its Hardinge Mill and process was, in law, a public use. Such use was more than two years prior to Shimadzu's application for his patents 1,584,150 and 1,896,020..... 15

CONCLUSION 19

TABLE OF CASES CITED.

	Page
Brown et al. v. Piper, 91 U. S. 37	11
Brush v. Condit, 132 U. S. 39	17
Dawson v. Follen, Fed. Case 3670	4
Doyle v. Spaulding, 19 Fed. 744	4
Dunbar v. Myers, 94 U. S. 187	11
Egbert v. Lippmann, 104 U. S. 333	17
Elizabeth v. Paving Co., 97 U. S. 126	12
General Pictures Co. v. Electric Co., 304 U. S. 175	13
Hall v. Macneale, 107 U. S. 90	17
Hanifen v. Godshalk, 78 Fed. 811	9
Hurlbut v. Schillinger, 130 U. S. 456	4
Kendall v. Winsor, 21 How. 322	11, 14
Milburn Co. v. Davis, etc. Co., 270 U. S. 390	5
Pennock v. Dialogue, 2 Pet. 20	4
Permutit v. Wadham, 13 Fed. (2d) 454	4
Rubber Co. v. Goodyear, 76 U. S. 788	10
Sewell v. Jones, 91 U. S. 171	4
Slawson v. Grand Street R. R. Co., 107 U. S. 649	11
Twyman v. Radiant Glass Co., 56 Fed. (2d) 119	17
Wilson v. Sherts, 81 Fed. (2d) 755	7, 9

STATUTES AND TEXT BOOKS CITED.

	Page
R. S. 4886	2, 3, 4, 5, 7, 9, 19
R. S. 4887	2, 3, 4, 5, 6, 19
R. S. 4900	9, 10
R. S. 4904	10
R. S. 4914, 35 U. S. C. Sec. 62	6, 8
R. S. 4915	6
R. S. 4918	6
R. S. 4920	10
R. S. 4923	3, 9
Nolan Act, Sec. 6, 35 U. S. C. Sec. 85	6
McElvey: Handbook of the Law of Evidence, 3rd Page 128	17
Walker on Patents, 6th Ed., Sec. 190	6
Wigmore on Evidence, Vol. I, Sec. 382	17

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REPLY BRIEF FOR PETITIONER.

Point I.

Save as provided in R. S. 4887, an invention made abroad does not come within the contemplation or cognizance of the patent statutes of the United States unless and until it has been patented or described in a printed publication here or abroad, or the invention has been communicated and described to some person or persons in this country.

Respondents have entirely misapprehended petitioner's Point I.

Respondents say (their brief p. 10) that

> "the precise question for the determination of this court is whether the phrase 'in this country' should be read into R. S. 4886 immediately following the words 'before his invention or discovery thereof' (both occurrences) *to limit the time and place of invention or discovery.*" *

Respondents are wrong.

Petitioner, of course, makes no contention that aliens may not obtain United States patents or that inventions

* Italicized matter throughout this brief is counsel's.

made abroad may not be here patented if the statutory conditions pertaining thereto are met.

What petitioner does say is that the originator, in this country, of a process and apparatus here known and used is no less an inventor than one who independently produces abroad the same process and apparatus. If either is an inventor, both are.

As between two such inventors, one of whom makes the invention here and the other makes the same invention abroad, R. S. 4886 makes the American invention the "new" and novel one, if, at the time the invention was made in this country, the foreign invention, although made first, had not been patented, described in a printed publication, bought within the purview of R. S. 4887, or communicated to any person in this country.

The statute R. S. 4886, likewise confers upon the inventor who thus made the invention in this country the rank of "first inventor".

These consequences flow from the statute, R. S. 4886, in that the words thereof, "not known or used by others *in this country*", require that unpatented and unpublished foreign inventions which have not been brought within the purview of R. S. 4887, or actually disclosed to some one in this country, are to be disregarded in determining the novelty of the invention here made. The status of the quality of novelty which attached to the invention made in this country and the rank of "first inventor", to which the inventor in this country became entitled at the time of his invention, cannot be destroyed or adversely affected by the subsequent importation in any manner into this country of the invention previously made abroad which was unpatented and unpublished at the time the invention was made in this country.

These results of the statute, R. S. 4886, are precisely the same, regardless of whether the inventor of the invention made in this country does or does not apply for or obtain a patent for his invention.

Consequently, knowledge and use in this country invalidates a patent granted for the same invention made abroad if at the time the invention (evinced by the knowledge and use in this country) was made in this country, the foreign invention, though theretofore made, was unpatented and unpublished and had not been brought within the purview of R. S. 4887 or communicated and disclosed to some person or persons in this country.

The Amendment of 1903 to R. S. 4887 merely provides an exception, in favor of those making inventions abroad, to the foregoing broad, general rule of R. S. 4886. The exception so created by the Amendment to R. S. 4887 "must be found within the four corners" of that Amendment. Indeed, if R. S. 4886 gave to inventions made abroad and their inventors equal rights of novelty and priority with inventions made in this country and the inventors thereof, the Amendment of 1903 to R. S. 4887 would serve no useful purpose.

Respondents' failure to appreciate the precise question here presented by petitioner results in part, perhaps, from respondents' erroneous assumption (pages 8, 9 of their brief) that petitioner's contention is based primarily, if not entirely, upon R. S. 4923, and not at all upon R. S. 4886.[1]

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[1] R. S. 4923 provides that a patent, granted under the conditions there specified, "*shall not be held to be void* on account of the invention or discovery, or any part thereof, having been known or used in a foreign country, before his invention or discovery thereof, if it had not been patented or described in a printed publication." [*Footnote continued on following page.*]

Under the first patent statute a "new" invention, as defined by the Congress, was one "not before known or used," thus making it essential that the invention be "new" to all the world.[2] By reason, however, of the inclusion of the words "in this country" in Sec. 24 of the Consolidated Patent Act of 1870 (16 Stat. 198) after the words "not known or used by others," knowledge or use of any unpatented and unpublished invention in a foreign country was deprived of its anticipatory effect.[3]

The amendment of 1870 is still in force as part of R. S. 4886. Under the concurrent findings of the courts below, petitioner was using commercially in June, 1921, in this country, at Philadelphia, a process and apparatus the same as, or substantially like, the inventions of the claims here in suit but which foreign inventions, in June, 1921, had not been patented, published, brought within the purview of R. S. 4887 or actually brought into this country.

If the subject matter of the claims here in suit constitutes patentable subject matter, so the like process and apparatus used commercially in Philadelphia in June, 1921, constitute like patentable subject matter.[4]

R. S. 4886 as it existed at the time of the grant of the patents here in suit and now exists, provided in effect that no person, otherwise entitled thereto, should be debarred *from receiving a patent* for his invention or discovery, because of prior knowledge or use thereof abroad, if the invention abroad had not been patented or described in a printed publication prior to the invention or discovery sought to be patented.

[2] *Sewell v. Jones*, 91 U. S. 171, 179-180; *Pennock v. Dialogue*, 2 Pet. 20, 22; *Dawson v. Follen*, Fed. Case 3670.

[3] *Hurlbut v. Schillinger*, 130 U. S. 456, 471; *Permutit v. Wadham*, 13 Fed. (2d) 454, 456; *Doyle v. Spaulding*, 19 Fed. 744.

[4] The inescapable result of the concurrent findings of the courts below that petitioner was using in June 1921

But the importation into this country after June, 1921, of the unpatented and unpublished inventions theretofore made in Japan did not affect the novelty of the process and apparatus here present and commercially used prior to such importation or deny to the inventor of petitioner's process and apparatus the rights or status of first inventor which prior to such importation, he had.

If the importation of such foreign inventions were permitted to bring about a transfer of novelty from the inventions being used in Philadelphia and a transfer of the rank of first inventor from the inventor thereof to the subsequently imported unpatented and unpublished inventions made abroad and the inventor thereof, the amendment of 1870 would be nullified and R. S. 4886 would be given the status and effect of the Patent Act of 1790.

The manifest result is that, as against knowledge and use of inventions in this country, prior to the importation into this country of the same or substantially the same inventions independently made abroad, the Patent Statutes of the United States proscribe all evidence of such foreign inventions, save that derived from patents, printed publications, or foreign applications within the purview of R. S. 4887.

---

the inventions of the claims of the patents here in suit, which were held valid and infringed, is that the process and apparatus so used in Philadelphia in 1921 were as much the result of inventive acts as were the process and apparatus claimed in Shimadzu's patents. Under the doctrine enunciated in *Milburn Co. v. Davis etc. Co.*, 270 U. S. 390, 401, it is, of course not necessary to show who did make the inventions in use by petitioner in June 1921 to show that Shimadzu did not. Their existence here prior to the importation of his unpatented and unpublished inventions denies to his inventions the quality of novelty, and denies to him the status of "first inventor".

Respondents' brief, page 20.

The last sentence of R. S. 4887 is but a limitation upon the rights of priority to which a foreign *application* for a patent may give rise.

Respondents' brief, page 21.

Walker on Patents, 6th Ed., Sec. 190, says:

> "If an invention was fully described in a caveat, then that caveat would constitute evidence showing that invention to have been made at least as early as the caveat was filed."

To the extent that a foreign invention was described in a caveat, that invention was thereby brought to this country and within the operation of the Patent Statutes.

Respondents' brief, page 23.

The Hall patents are not here in issue. Petitioner is here claiming no rights thereunder. Had Hall been denied a patent by the Court of Customs and Patent Appeals, petitioner would not in this case have been affected thereby; for R. S. 4914, 35 U. S. C. Sec. 62, provides:

> "But no opinion or decision of the court in any such case shall preclude any person interested from the right to contest the *validity* of such patent in any court wherein the same may be called in question."

Respondents' brief, page 24.

The "other proceedings" referred to in section 6 of the Nolan Act, 35 U. S. C., Sec. 85, are not limited to proceedings under R. S. 4915 and R. S. 4918. "Proceeding" is a word of broad import. It includes

"The instituting or carrying on of an action at law; a legal action or process; any act done by authority of a court of law; any step taken in a cause by either party." Oxford Dictionary.

Respondents' brief, page 25.

Respondents there say:

"Before the Amendment of 1903, the written description in a foreign application was evidence of a conception, being a written disclosure of the invention."

Respondents cite no case supporting that statement. Petitioner has found none. Indeed it is directly in conflict with *Wilson v. Sherts,* 81 Fed. (2d) 755 (petitioner's main brief, pp. 18, 19), and like cases.

Respondents' brief, page 26.

Here again respondents assert that the only possible limitation upon the right of a foreign inventor to have the benefit of the actual date of his invention abroad is R. S. 4923.

As against knowledge and use in this country of the same or substantially the same invention prior to the importation into this country of an unpatented and unpublished invention made abroad, R. S. 4886 constitutes a complete bar to any claim of the inventor of such foreign invention to the benefits of the date of his invention abroad. The prior user of the same invention here, or the person through whom he claims, is, under R. S. 4886, no less an inventor than he who made the invention abroad. This is equally true whether the thing here used, prior to the importation of the unpatented and unpublished foreign in-

vention, was or was not patented. (Petitioner's main Brief, p. 25).

Respondents' brief, page 28.

Respondents here say:

> "Hall and petitioner are estopped from claiming Shimadzu's patent rights by reason of the amendment filed in the Patent Office by Hall accepting limited claims in the Hall patents."

Respondents' statement is misleading. Petitioner is not claiming Shimadzu's patent rights. Petitioner denies that Shimadzu has any valid patent rights. That which Petitioner does contend is that any rights to practice the inventions of the process and apparatus claims of the patents here in suit were, long prior to any date to which Shimadzu is entitled as his date of invention under the Statutes, known to and used by some member or members of the American public and, hence, vested in the American public.

The Hall patents are found in R. III, pages 37 and 41. They are referred to in a footnote on page 32 of petitioner's main brief. They are without pertinency to the issues presented to this court. The question here raised is whether Shimadzu's patents are valid. R. S. 4914, 35 U. S. C. Sec. 62 deals with the determination of appeals from the Patent Office by the court having jurisdiction to hear such appeals. The last sentence of that section says:

> "But no opinion or decision of the court in any such case shall preclude any person interested from the right to contest the validity of such patent in any court wherein the same may be called into question."

Respondents' brief, page 29.

Here respondents refer to the express statutory provision with respect to foreign patents and publications.

Shimadzu's inventions, however, were not patented or described in any printed publication in this or any foreign country until long after June, 1921.

Respondents' brief, pages 29-31.

Respondents here indicate that a reversal of the decrees below would bar the grant of United States letters patent for any invention made abroad. Manifestly, such is not the case. The conditions under which valid patents for foreign inventions have been and may be granted are those set out in the statutes and summarized in *Wilson v. Sherts,* 81 Fed. (2d) 755. Indeed, according to the figures cited by respondents (footnote, page 31), 4900 such patents were granted during the year 1937. Yet the Patent Office construction of the Patent Statutes, under which those patents were granted, is precisely the construction thereof for which petitioner here contends. (Petitioner's main Brief, pp. 17-19.)

Respondents' brief, pages 34-37.

Opinion in Hanifen v. Godshalk, 78 Fed. 811.

The deletions made in R. S. 4886 when there quoted by the court are a demonstration that the court in that case did not have brought to its attention the interpolation of the words "in this country" in what is now R. S. 4886, by Sec. 24 of the Consolidated Patent Act of 1870 (16 Stat. 198), or the legal consequences thereof. The court there apparently based its conclusion upon R. S. 4923 only, which provides that a patent shall not be held void because of unpatented and unpublished prior knowledge or use in a foreign country.

The court likewise apparently failed to observe that the issue of priority "in any action for infringement" under

paragraph 4th of R. S. 4920, is the identical issue in interference proceedings in the Patent Office under R. S. 4904.

Again, the court assumed that which was to be proved: namely, that the defendant was "an infringer" instead of a member of the American public who was entitled to rely in support of his defence of invalidity of the patent there in suit, on the patents granted prior to the importation into this country of the then unpatented and unpublished foreign invention.

Point II.

If Shimadzu's acts in Japan are within the cognizance of the patent statutes of the United States, he suppressed, concealed and withheld his inventions until long after petitioner had brought into commercial use in this country inventions similar to or identical with his.

(1) Respondents (their brief, p. 39) rely upon *Rubber Co. v. Goodyear*, 76 U. S. 788, 801, to sustain their contention that the defense that Shimadzu suppressed his inventions, may not be here availed of in that it was not set up in the answer. The Goodyear case does not so hold. The defense there pleaded was that the patented articles had not been marked "patented" in conformity with R. S. 4900.

That fact was available for pleading long prior to the trial of the case. In the case at bar, petitioner contended and believed that the inventions of the patents in suit had been claimed and patented in Japanese patents 41,728 and 42,563 (R. III, pp. 30-33), and contended that the patents in suit were invalid because those Japanese patents issued prior to the patents in suit and the applications therefor were not filed within twelve months prior to the filing of the applications in this country for the patents in suit. The courts below denied this defense of petitioner, held that

these Japanese patents were not for the same invention as the patents in suit, and that the date of Shimadzu's "invention" and *"successful reduction to practice,"* in Japan was not later than August, 1919. (R. II, p. 1166).

The courts below likewise held (R. II, p. 1172):

> "We are not concerned with the motives which prompted him, in taking out the '563 patent, to confine it to the single step of mechanical removal of the dust from the drum, and to *withhold* the really essential steps of the invention for later patenting. It is sufficient to say that he had the right to do this if he chose."

That the patents in suit are invalid (if Shimadzu's acts in Japan are within the cognizance of the patent statutes of the United States) because Shimadzu suppressed, concealed and withheld his inventions for years after he had reduced them to actual practice in Japan, became apparent only after and because of the conclusions of the courts below, i. e., that Shimadzu is entitled to rely upon the date of his invention and reduction to practice in Japan, and that Japanese patents 41,728 and 42,563 are not for the same inventions as the patents in suit. A defense so arising seems analogous to the defenses in *Slawson v. Grand Street R. R. Co.*, 107 U. S. 649, *Dunbar v. Myers*, 94 U. S. 187, and *Brown et al. v. Piper*, 91 U. S. 37, 44. Indeed, in those cases the bill was dismissed because the inventions described in the patents were not patentable, although no such defense was set up in the answer. Here the invalidity of the patents in suit appears from the face of the opinions below, when measured by the rule of law laid down in *Kendall v. Winsor*, 21 How. 322. A decree of validity in the face of findings showing invalidity would be as incongruous and inequitable as a decree of validity when invalidity appears from the face of the patent.

(2) In their paragraph (2) of Point II, beginning on page 39 of their brief, respondents attempt to excuse Shimadzu's withholding his inventions, first on the ground that he was installing new mills and engaging in further experiments in the perfection of his invention, and second because there were no intervening rights between the date of the inventions in August 1919 and the filing of the applications for the patents here in suit.

To the first of these contentions of respondents, it is a sufficient answer that both courts below found (R. II, 1166, 1178) that in August 1919 Shimadzu had not only a conception of his inventions, but as well a "successful reduction to practice" in Japan. Under such facts the doctrine of *Elizabeth v. Paving Co.*, 97 U. S. 126, touching further experiments, is without application.

With respect to respondents' second contention with regard to rights intervening between August 1919, and the filing of the applications for the three patents here in issue, respondents seek to give some value and pertinency to Shimadzu's application of December 1920 (PX39). It has none. In that application Shimadzu said:

> "I pulverize metallic lead by mechanical means into fine powder."

The powder so obtained was then oxidized. As stated by the Examiner in his communication of October 20, 1921:

> " . . . the method employed in obtaining the lead in the finely divided condition used, is not given."

On July 18, 1922, more than twelve months after the commercial use of petitioner's process and apparatus in Philadelphia in June 1921, Shimadzu attempted to cure that defect by amendments. In a communication from the

Examiner to Shimadzu's solicitors, dated May 17, 1923, the Examiner stated:

> "The amendment to page 2 regarding the pulverizing of the lead is considered to involve new matter and should be canceled."

Respondents here state (their brief, page 40):

> "Obviously in view of all the testimony of record the 'mechanical means' referred to (in the application of December 1920) is the rotating drum used by Shimadzu in 1919 . . ."

But the disclosure of the application cannot be now so amended. Consequently, the application of December 1920 and the attempted amendment thereof in July 1922 are without the remotest pertinency to the issues here. Respondents did not and do not even attempt to point to common subject matter between that application and the claims here in issue. They merely assert that the patents here in suit were granted on "continuation applications" based upon the application of December 1920. In order to establish, respondents refer to *General Pictures Co. v. Electric Co.*, 304 U. S. 175, 183, and quote therefrom as follows:

> "The effective dates of the claims of the continuation applications are those of the original applications."

Respondents fail to quote from the opinion in that case the statement of that which alone makes a later co-pending application a continuation application to an earlier one. That statement, p. 183, is,

> "The subjects matter of the claims of the other two patents were disclosed in the original applications and were claimed in the continuation application upon which they issued."

The application of December 1920 did *not* disclose the subject matter of any of the claims here in issue. As a consequence, none of the claims here in issue can have an effective date earlier than that of the respective applications for the patents here in issue containing such claims.

On pages 42-43 of their brief, respondents cite *Kendall v. Winsor*, 21 How. 322, 328, to establish that an inventor is entitled to "a delay requisite for completing an invention, . . .".

This, too, ignores the fact that both courts below found that the inventions of the patents here in suit had been *reduced to practice* in August 1919 and the further fact that Shimadzu himself testified (R. II, 1140) that from June 1920 he was "producing at the same time for commercial purposes."

Yet, Shimadzu continued "to *withhold* (R. II, 1172) the really essential steps of the invention" from the American public for years thereafter and until long after like inventions were brought into commercial use by petitioner in Philadelphia in June 1921.

Respondents' arguments on these points leave them on the horns of a dilemma. Either Shimadzu did not have the inventions of the claims here in issue until about the time he filed his applications for the patents containing them, or if he did, he withheld, suppressed, and concealed them from the American public until long after some member or members of the American public had here made the inventions and brought them into commercial use. In neither case are the patents in suit valid.

Point III.

Petitioner's commercial use in June 1921 of its Hardinge Mill and process was, in law, a public use. Such use was more than two years prior to Shimadzu's application for his patents 1,584,150 and 1,896,020.

The courts below did not find that there was not any public use by petitioner in June 1921 of the inventions called for by the claims here in issue.

On the contrary, both courts below found (R. II, 1192):

> "It is therefore plain that there is no evidence of anything beyond an *experimental* use by the defendant earlier than about the middle of the year 1921 . . .
>
> "*Commercial production* (by petitioner) by the Hardinge Mill with its forced air draft undoubtedly involved the use of plaintiff's patent, and June 1921 may be fixed as the date when that began."

The finding of "commercial production" by petitioner in June 1921 was in contrast with the "experimental use" of the inventions in the early part of the year 1921.

Moreover, the finding of "commercial production" in June 1921 was made by the trial court after a rehearing at the instance of respondents. A special memorandum with respect thereto was filed by the trial court (R. II, 1189-1192). The implication of this memorandum would seem to be that the trial court intended to find, by "commercial production" in June 1921 as distinguished from January 1921, a public use. True, the trial court did not expressly so state. But certainly it did find "commercial production", as distinguished from "experimental use", in June 1921.

Yet, respondents state in their brief, page 52, that

"... petitioner has shown no production for the year 1921 ..."

Respondents in making this statement, have overlooked the direct oral and documentary evidence to the contrary. Indeed, the finding of the court was dictated by uncontradicted oral and documentary evidence (R. I, 463). Log sheets typified by those of June 14, 1921 (DX60) show that petitioner then produced 1,500 pounds of gray oxide per eight hour shift. They also show regular written determinations, four or five per shift, of specific gravity and oxidation, demonstrating complete control of the process (DX48-58).

The lead dust so produced was used to make battery plates (R. I, 465).

One Cooper, who went to work for petitioner in June 1923 and left sometime in 1930 (R. I, 401), was respondents' voluntary witness with respect to the process and apparatus used by petitioner during that time. As shown by the evidence (R. I, 460-466) and by the findings of the courts below (R. II, 1175), the process and apparatus then employed were the same as those employed by petitioner in June of 1921. Petitioner's process and apparatus were likewise explained to respondents by one Nagle, also a former employee of petitioner (R. I, 420, 423). The record does not show the period of his employment.

Under such circumstances respondents are manifestly estopped from asserting that petitioner's use of its process and apparatus was secret during the time of Cooper's employment. But it is believed that that estoppel includes not only the time of Cooper's employment, but *all* the time during which the process and apparatus have been used by petitioner. That a previously existing state of things is presumed to continue to exist has been well established.

McKelvey's Handbook of the Law of Evidence, Third Edition, page 128, says:

> "*subsequent* facts are frequently relied upon to prove a previously existing state of facts."

Wigmore on Evidence, Vol. I, Sec. 382, says:

> "It has already been seen (ante Sec. 190) that the prior *or the subsequent* existence of a quality or condition is evidence of its existence at a given time . . . . Such evidence is receivable to show the mode of conducting a business . . . and so on."

Moreover, in *Twyman v. Radiant Glass Co.*; 56 Fed. (2) 119, the Circuit Court of Appeals for the Eighth Circuit held that the use of an alleged infringing mold in which glass cylinders were made was a public use, upon the ground that the glass cylinders there made were produced for commercial purposes.

The ruling of this Court in *Egbert v. Lippmann,* 104 U. S. 333, is summarized in the second paragraph of the syllabus thus:

> "There may be a *public* use of the invention although but a single machine or device for which the Letters were subsequently granted, was used only by one person."

In *Brush v. Condit,* 132 U. S. 39, 49, this Court, quoting from its opinion in *Hall v. Macneale,* 107 U. S. 90, 97, said:

> "The construction and arrangement and purpose and mode of operation and use of the bolts in the safes were necessarily *known to the workmen* who put them in. They were, it is true, hidden from view, after the safes were completed, and it required a destruction of the safes to bring them into view. But this was no concealment of them or use of them in secret."

The same statement could be made in substance with respect to petitioner's use of its process and apparatus in June, 1921 and thereafter.

Respondents' brief, pages 56-58:

On page 56 of their brief, respondents say:

> "Petitioner's uses were clearly experimental from June, 1921, on until the end of that year and in fact until 1923, when standardized machines were bought."

That statement is in direct conflict with the concurrent findings of the courts below. It is likewise in direct conflict with the evidence, both oral and documentary. (R. I., 460-468 and exhibits there referred to.)

The statements of respondents on pages 56-58 of their brief, that petitioner's uses were experimental from June 1921 until 1923, are most inept.

If the matters there asserted to evince an experimental state and to negative complete invention, have that effect, then respondents have established completely that the patents here in suit are wanting in invention; for those patents make no disclosures of the facts which respondents, on pages 56-58 of their brief, would make indispensable to the existence of the invention.

Indeed, Shimadzu's patents here in suit show to the point of demonstration that Shimadzu had not arrived, even at the time he filed his several applications for these patents, to that state of knowledge in lead dust manufacture, which petitioner had attained as early as July 24, 1917. DX78 (R. III, 26-29) is a report made in July 1917 by Mr. Kershaw, an employee of petitioner, of the processes employed and the results obtained by petitioner's operation of its so-called Tudor Mill which was a duplicate or reproduction of mills

long theretofore in use in Germany for the manufacture of lead dust. (R. I, 539.)

Patents 1,584,150 and 1,896,020 are, therefore, invalid also because of two years public use of the alleged inventions thereof before the applications therefor were filed (R. S. 4886, and 4887).

CONCLUSION.

Under the concurrent findings of the courts below, the claims of Patents Nos. 1,584,149, 1,584,150 and 1,896,020, here in suit are invalid.

Respectfully submitted

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February 7, 1939.

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IN THE

Supreme Court of the United States

No. 441, October Term, 1938

THE ELECTRIC STORAGE BATTERY CO.,
Petitioner,

vs.

GENZO SHIMADZU AND NORTHEASTERN ENGINEERING CORPORATION
Respondents.

BRIEF FOR RESPONDENTS IN OPPOSITION TO PETITION FOR A WRIT OF CERTIORARI

EDMUND B. WHITCOMB,
GEO. WHITEFIELD BETTS, JR.
Counsel for Respondents.

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INDEX

BRIEF IN OPPOSITION TO PETITION FOR CERTIORARI — Page 1

Opinions Below — 1

Jurisdiction—Reasons of the Character Advanced by Petitioner for Issuance of Writ of Certiorari are Insufficient — 1

STATUTES INVOLVED — 2

STATEMENT — 2

SUMMARY OF ARGUMENT — 4

This Is An Ordinary Patent Case Not Involving Any Special Matter Warranting Certiorari — 4

Lurking Questions — 5

ARGUMENT — 6

POINT I — 6

There is No True Conflict between the Two Alleged Conflicting Groups of Cases Referred to by Petitioner. Both are in Harmony as they Apply to Different Sets of Facts — 6

Main Statutes and Applicable Important Decisions — 7

Cases Under Group (A) Petitioner's Erroneous Attempt to Show Conflict — 9

Group (B) Cases Sustaining Right of Patentee to Defend His Patent by Foreign Fact Testimony Against Attack by Infringer are Not Inconsistent with the Foregoing Cases of Group (A) — 14

The Circuit Courts of Appeals Have Announced and Maintained This Sharp Line of Distinction Between These Cases of Groups (A) and (B) — 16

Page

POINT II 18

In Failing to Find that There was a Prior "Public Use" of the Inventions Here in Issue Within the Meaning of R. S. 4886 and R. S. 4887 the Courts Below Have Not Decided a Federal Question in Conflict with Applicable Decisions of this Court or a Circuit Court of Appeals.

POINT III 20

Suppression of Inventions During Which Intervening Rights have Accrued Warranting Estoppel Against Shimadzu to Prove True Dates of Invention Not Shown and There is No Conflist as to the Law Applicable.

CONCLUSIONS 22

APPENDIX

R. S. Sec. 4886. Inventions Patentable 23

R. S. Sec. 4887. Inventions Previously Patented Abroad 23

R. S. Sec. 4892. Oath of Applicant 24

R. S. Sec. 4920. Pleading and Proof in Action for Infringement 25

R. S. Sec. 4923. Patent Not Void for Previous Use of Thing in Foreign Country 26

AUTHORITIES

Page

Angle et al. v. Richardson, 19 Fed. Sup. 1002, 1004 18

Badische Anilen & Soda Fabrik v. A. Klipstein & Co. 125 F. 543 .... 15, 17

Bingham v. United States, 296 U. S. 211, 218 6

Brush Electric Co. v. Julien Electric Co., 41 F. 679 11

The Byrne Manufacturing Company v. American Flange & Manufacturing Co., Inc., 58 Sup. Ct. 18 18

Claude Neon Lights, Inc. v. Rainbow Light, Inc., 47 F. (2d) 345 .... 15, 17

Dewey v. United States, 178 U. S. 510, 521 10

Electrical Accumulator Co. v. Brush Electric Co., 52 F. 130 11

Electrical Accumulator Co. v. Julien Electric Co., 38 F. 117 11

Elizabeth v. Pavement Company, 97 U. S. 126, 134 135 .... 5, 19

Gayler et al. v. Wilder, 10 How. 477, 496 7

General Talking Pictures Corp. v. Western Electric Co., et al., 304 U. S. 175, 178-179 .... 18, 21

Hall v. Shimadzu (1932), 59 Fed. (2d) 225 3

Hanifen v. E. H. Godshalk, 78 Fed. 811, 812, 813 .... 12, 15

Hanifen v. Price, 96 F. 435, 440, 441 .... 15, 17

Ireson v. Pierce, 39 F. 795 13

Jay v. Weinberg, 250 F. 469 13

Jurisdiction of the Supreme Court of the United States, Robertson and Kirkham, §304, p. 611, note 93 6

Keller v. Adams-Campbell Co., 264 U. S. 314, 319 2

Kendall v. Winsor, 21 How. 322, 328 21

AUTHORITIES

	Page
Lake County v. Rollins, 130 U. S. 662, 670	10
Patents Selling & Exporting Co. v. Dunn, 213 F. 40	12, 13
Shimadzu et al. v. Electric Storage Battery Co. (D. C.) 17 Fed. Supp. 42	1
Shimadzu et al. v. Electric Storage Battery Company, D. C. Rehearing) 36 U. S. P. Q. 25	1
Texas & N. O. R. Co. v. Brotherhood, 281 U. S. 548, 556	5
Treat v. White, 181 U. S. 264, 267	10
Vacuum Engineering Co. v. Dunn, 209 F. 219	12, 13
Webster v. Fall, 266 U. S. 507, 511	6
Welsbach Light Co. v. American Incandescent Lamp Co., 98 F. 613, 615	14, 15, 16

STATUTES CITED

R. S. 4886 (See Appendix)	23
R. S. 4887 (See Appendix)	23
R. S. 4892 (See Appendix)	24
R. S. 4920 (See Appendix)	25
R. S. 4923 (See Appendix)	26
Section 240 (a) of the Judicial Code, as amended	1
R. S. 4887 (See Appendix)	19
R. S. 4892 (See Appendix)	20
R. S. 4920 (See Appendix)	21
R. S. 4923 (See Appendix)	22

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Opinions Below

The opinion of the District Court for the Eastern District of Pennsylvania (R. II, 1162-1189) is reported in 17 F. Supp. 42. A supplemental opinion of the District Court, not included in the record filed by petitioner, is reported in 36 U. S. P. Q. 25. The opinion of the Court of Appeals for the Third Circuit is reported in 98 F. (2d) 831.

JURISDICTION—REASONS OF THE CHARACTER ADVANCED BY PETITIONER FOR ISSUANCE OF WRIT OF CERTIORARI ARE INSUFFICIENT.

The judgment of the Circuit Court of Appeals affirming the decree of the District Court was entered August 8, 1938 (R.II, 1226). A petition for rehearing was denied September 14, 1938 (R. II, 1255). The petition herein was filed October 27, 1938, in which jurisdic-

tion of this Court is sought under §240 (a) of the Judicial Code, as amended. However, respondents submit that the instant case is merely "an ordinary patent case with the usual issues of invention, breadth of claims and * * infringement", which "this Court will not bring here by certiorari unless it be necessary to reconcile decisions of Circuit Courts of Appeal on the same patent," **Keller v. Adams-Campbel Co.**, 264 U. S. 314, 319.

As only one Circuit Court of Appeals has passed on the patents here involved, there are no conflicting decisions on these same patents.

There are no special or important reasons for granting the writ sought as the case affects only the parties to this litigation. The case presents no conflict of opinion upon the same matter between two Circuit Courts of Appeals. The case presents no important question of federal law which has not been but should be settled by this Court; it presents no question of law important to the public as distinguished from the parties; it presents no conflict with any decision of this Court.

In fact, no real question of law is presented. Petitioner seeks merely a review of the facts.

STATUTES INVOLVED

Sections 4886, 4887, 4892, 4920 and 4923 of the Revised Statutes are quoted in the appendix.

STATEMENT

This suit was commenced in the United States District Court for the Eastern District of Pennsylvania for infringement of certain claims of patents Shimadzu Nos. 1,584,149, 1,584,150 and 1,896,020, and claims of three additional patents not now in controversy. The patents involve a highly meritorious process for making a fine lead powder by oxidation abrasion of metallic lead in a dry state, the powder being used in the manufacture of storage batteries.

The record establishes that the patentee's filing dates are January 30, 1922, July 14, 1923, and April 27, 1926, (the application of the later date being entitled to the date of the first cases), whereas the Hall patent, which represents the development of petitioner's alleged 1921 "knowledge and use," was not filed in the United States Patent Office until March 29, 1924. The record shows that many experiments were made by Hall from the time he began until October, 1923, (after Shimadzu's application for the '250 patent was filed).

Not until after October, 1923, (R. I., 467) did Hall arrive at a point in the development which would permit him to employ the invention successfully and economically. Prior to this time his experiments were in a direction which would never have led to success.

The District Court did not make a definite finding herein that production of the material by the process in question could be fixed as of June, 1921, the Court merely holding that such date "may" be so used. (R. II 1175). The Court of Customs and Patent Appeals, **Hall** v. **Shimadzu,** (1932,) 59 Fed. (2d) 225[1], in interference proceedings affirmed the Patent Office in holding that Hall, petitioner's employee, was unsuccessful in establishing conception or reduction to practice of the subject matter of the counts prior to Shimadzu's filing date.

However, on the facts of the record, it was concurrently found by the Courts below as follows: Respondent Shimadzu commenced his experiments in September, 1918, in Japan (R. II, 1163). The date of invention and successful reduction to practice is not lator than August, 1919, (R. II, 1166).

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1. That court stated, page 228:

"We are of the opinion that the Board of Appeals committed no error in finding"—"that the record is insufficient to establish conception or reduction to practice of the subject matter of the counts by appellant (Hall) prior to appellee's (Shimadzu) filing date.

"For the reasons stated the decision of the Board of Appeals in this interference is affirmed."

Although Shimadzu applied for and obtained several Japanese patents, only Japanese patent, No. 60,825, corresponds with United States patent No. 1,584,150, which was applied for within one year of the Japanese application date, and the lower Court so indicated (R. II, 1172).

The District Court carefully considered all the defenses including the prior patents, uses, etcetera, relied on by petitioner and held that they did not constitute anticipation of respondents' patents. The Circuit Court of Appeals, after outlining the scope of the issues presented to it for determination, adopted the opinion of the District Court holding for respondents.

SUMMARY OF ARGUMENT

This is an Ordinary Patent Case Not Involving any Special Matter Warranting Certiorari.

Petitioner's Point I, alleging confusion of the law, is not sound because no such conflict or disagreement in the courts below exists. In contests on priority between rival inventors for the establishment of one patent right, all courts have been consistent in excluding the introduction of fact testimony relating to acts done in a foreign country.

On the other hand, in infringement suits the courts have all consistently permitted an inventor, whether a citizen of the United States or foreigner, to show the true facts whether occurring in the United States or in a foreign country in proving his actual and not his artificial date of invention in order to overcome alleged prior uses and other defenses advanced by defendant.

As to petitioner's Point II based upon the alleged defense of public use, a defense which must not only be specifically pleaded but also proven beyond a reasonable doubt, respondents submit that petitioner being apprised of all the facts, did not plead public use in the answer or submit proofs thereon. Although the decisions below

refer to petitioner's "Hardinge mill" operations in 1921 as involving a "use" of plaintiffs' patents, the record shows in detail petitioner's subsequent extensive experiments bringing such experimental "uses" within the rule applied by the Court in **Elizabeth v. Pavement Co.**, 97 U. S. 126. Consequently, the courts below very specifically avoided any holding of public use in the statutory sense of the term. That the activities of petitioner referred to were private and not public is also evidenced by the fact that it required an order of the court before an inspection by the court's expert of petitioner's plant was allowed. (R. I., 2, 3).

Petitioner's Point III also relates to facts that were not pleaded in the answer, not urged in the District Court, and not proven by the record which on the contrary shows there was no suppression of the invention by the patentee. Petitioner is here again merely seeking to obtain a review of the facts in this case although the decisions of the lower courts are in no way inconsistent with any applicable decisions of this Court.

Respondents therefore submit that this is an ordinary patent case involving only fact questions of validity, scope of claims and infringement. These issues have been flatly resolved against petitioner by the concurrent rulings of the two courts below, a determination which, under the two-court rule applied by this Court, is not reviewable here. **Texas & N. O. R. Co. v. Brotherhood**, 281 U. S. 548, 556. There is no conflict with the decision of any other federal court as to the validity of the three patents here involved. Respondents perceive no ground upon which the present case can be differentiated from any other "ordinary patent case."

Lurking Questions

The questions (pet. 20-21) which petitioner says are so important that they should move this Court to grant certiorari—in the absence of a conflict as to the patents

involved—and present "a legal bewilderment upon an issue of broader public concern, it is believed, than that which arises when Circuit Courts of Appeals differ with respect to the construction or validity of the same patent"—are at best mere "lurking questions."[2] Even if it could be said that the case genuinely involves all of the issues which petitioner asserts as reasons for granting the writ, the opinion of the District Court and that of the Circuit Court of Appeals will be read in vain for a discussion of these issues. Not once in the course of the District Judge's opinion will a reference be found to R. S. §§4886, 4920 or 4923. R. S. §4887 is referred to only in connection with another issue quite apart from that now raised by petitioner. The embarrassment and confusion which petitioner indicates will follow the decisions below is, therefore, entirely improbable.

ARGUMENT

POINT I

There is no True Conflict between the Two Alleged Conflicting Groups of Cases Referred to by Petitioner. Both are in Harmony as They Apply to Different Sets of Facts.

On the one hand is the rule (A) as to whom of interfering contestants "priority of invention" shall be awarded and whether United States "patent rights" may be defeated by proof of unpublished activities in a foreign country (Sections 4886, 4923 R. S.).

On the other hand is the rule (B) that is applied in determining whether or not a United States patent granted on a foreign invention is valid as against an infringer's assertion of prior knowledge and use or other defenses allowing patentee to show the actual, not artificial, date of invention to rebut such defenses.

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2. Robertson and Kirkham, **Jurisdiction of the Supreme Court of the United States**, s304, p. 611, note 93, citing **Bingham** v. **United States**, 296 U. S. 211, 218, and **Webster** v. **Fall**, 266 U. S. 507, 511.

Main Statutes and Applicable Important Decisions.

The several sections of the Patent Acts should be taken together **(Gayler et al. v. Wilder, 10 How. 477, 496).**

R. S. 4886 (USC, Title 35, Sec. 31) states the conditions precedent to the grant of a valid patent, specifying in part that:

> "Any person who has invented or discovered any new and useful art * * * not known or used by others in this country, before his invention or discovery thereof * * *."

is entitled to a patent. At the outset, it is important to note the significance of the words "Any person" which obviously includes either a citizen of the United States or of any foreign country. The Act of 1793 limited the right to obtain a patent to "citizens of the United States." The act of April 17, 1800, extended the privilege to "aliens, who, at the time of petitioning, had resided for two years within the United States," (48 C. J., 123.) In 1836 and in all amendments since, Section 4886 extended the privilege to "any person." Thus, the present statute granting the right to obtain a patent to "any person who has invented or discovered any patentable invention contains no limitation with respect to the citizenship of the inventor," (48 C. J. 123.) Moreover, this statute does not require that a person must have invented or discovered **in the United States** an art "not known or used by others in this country," nor does it require that the invention shall not be known or used by others in this country before his invention or discovery thereof **in the United States.** He must be the inventor of something which is not known or used by others in the United States **at the date of his invention or discovery** irrespective of the country in which the invention or discovery was made. Respondents rely on the right granted in Section 4886 to show the actual date of invention.

Moreover, as a condition precedent to the grant of a valid patent, the applicant must make oath as required by R. S. 4892 (USC, Title 35, Sec. 35) which includes:

> "The applicant shall make oath that he does verily believe himself to be the original and first inventor or discoverer of the art * * * for which he solicits a patent; that he does not know and does not believe that the same was **ever** before known or used."*

Again, there is no qualification as to place in which the invention is made but the applicant, to obtain a valid patent, must assert the belief that he was the first and original inventor of that which was not known or used before the date of his invention.

Reference is also made to R. S. 4920 (USC, Title 35, Sec. 69) expressly providing as the fourth defense:

> "That he was not the original and first inventor or discoverer of any material and substantial part of the thing patented;"

as this in effect corresponds to the condition precedent required by R. S. 4886 and of the allegation contained in the oath required by R. S. 4892.

Petitioner has referred to (Footnote, p. 19 of Petitioner's Brief) and respondents primarily rely upon the cases arising under the foregoing sections of the statute which have permitted a United States patentee, whose invention was made abroad, to show the actual facts as to his dates of invention, as distinguished from the artificial date of invention on which he filed a corresponding application for patent in a country foreign to the United States. All the cases in this group are in perfect harmony.

Petitioner also refers to Section 4923, but respondents submit the same obviously does not here apply. The

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* Emphasis in all quotations is ours unless otherwise expressly noted.

very title of this section shows that it relates to an entirely different subject—"Patent not void for previous use of thing in foreign country."

This section is only intended to render a knowledge or use in a foreign country ineffective to invalidate a patent once granted in the United States, regardless of whether the inventor of the patent in question was a citizen of the United States or a foreigner. The provisions of this section make it clear that unpatented or unpublished uses or knowledge in foreign countries shall not be available to invalidate a United States patent.

However, in view of R. S. 4886, as now amended, to include the words "in this country" after the words "not known or used by others" apparently R. S. 4923 is merely repetitious and respondents agree with petitioner in its statement in the footnote in the appendix that insofar as affecting determination of validity of patents once granted "It would seem that R. S. 4923 has now become *functus officio.*"

Cases Under Group (A)—Petitioner's Erroneous Attempt to Show Conflict.

Petitioner has attempted to classify the instant case under R. S. 4887 (USC, Title 35, Sec. 32) only, but respondents maintain that this statute merely refers to the right of a foreign inventor to obtain the benefit of his foreign filing date under the International Convention which is wholly aside from his right to also show actual dates of invention in an infringement suit. Thus, R. S. 4887 contains two distinct provisions. The first paragraph prescribes that the patent granted in this country shall not be defeated by a like patent granted in a foreign country to the same inventor at an earlier date if the United States application is filed within twelve months of the application date of the said foreign patent. This paragraph of R. S. 4887 is not here involved, as Shimadzu's United States application was filed within the

year of his related Japanese application in the only instance of correspondence between Shimadzu's United States and foreign patents.

Referring to the second paragraph of R. S. 4887 particularly relied upon by petitioner in its Reason I, attention is called to the fact that this entire paragraph is limited to patent "applications" in contradistinction to paragraph one which includes both patent applications in United States Patent Office and also deals with "patents" already granted. Petitioner's attempt to imply that consequently other acts relating to facts of priority, such as conception, diligence and actual reduction to practice cannot be shown is wholly unwarranted in view of the rule of law that courts should be extremely careful not to add anything to a statute by interpretation which was omitted therefrom by Congress. See **Lake County v. Rollins,** 130 U. S. 662, 670; **Treat v. White,** 181 U. S. 264, 267; **Dewey v. United States,** 178 U. S. 510, 521, where this Court stated:

> "Our province is to declare what the law is, and not, under the guise of interpretation or under the influence of what may be surmised to be the policy of the Government, so to depart from sound rules of construction as in effect to adjudge that to be law which Congress has not enacted as such. Here, the language used by Congress is unambiguous. It is so clear that the mind at once recognizes the intent of Congress. Interpreted according to the natural import of the words used, the statute involves no absurdity or contradiction, and there is consequently no room for construction. Our duty is to give effect to the will of Congress, as thus plainly expressed."

The second paragraph of R. S. 4887 relates only to the right in a foreign inventor to rely on his convention date for certain purposes, and obviously purposely does not prohibit or relate to the right of the patentee in patent infringement suits to show the actual, not artificial,

date of invention by conception, diligence and actual reduction to practice either in the United States or in any foreign country, a right clearly permitted under Section 4886 to allow an inventor to defend his patent. It is therefore respectfully submitted that all the cases cited by petitioner on pages 14 through 17 relate fundamentally to the administrative rule or to a contest on "priority of invention" and come within category of rule (A) supra rather than in the class of cases category of rule (B) relied upon by respondents.

The three cases of **Electrical Accumulator Co.** v. **Julien Electric Co.**, 38 F. 117, **Brush Electric Co.** v. **Julien Electric Co.**, 41 F. 679, and **Electrical Accumulator Co.** v. **Brush Electric Co.**, 52 F. 130, should be considered together because, insofar as here concerned, they also deal with a "priority of invention" as between Brush, a citizen of the United States, and Faure, a citizen of France. Interferences had been set up in the Patent Office and decided in favor of Brush (38 F. 130; 41 F. 686; 52 F. 134). In the earliest of these three suits (38 F. 117) suit was brought on the Faure United States patent and Brush was set up as the prior inventor (p. 128); the Court found that Brush was prior to Faure, as had been done in the Patent Office (p. 130), and restricted Faure to the issue date of his French patent for his date of invention—as would have been done in the Patent Office during the interference. In the second and third of these cases (41 F. 679 and 52 F. 130) the Brush patents were in suit and the Court ruled in favor of Brush on the contest of rival claimants for determination of "priority," ruling in effect that Faure's work in France could not defeat Brush's United States patent, as provided by R. S. 4923 in the absence of a patent or printed publication. Thus these cases are not concerned with the question in the instant case of a plaintiff patentee proving that he is *defacto* the first inventor against the attack of an infringer. In the first of these cases the question was real-

ly an issue involving rival claimants for the same patent on priority of invention and the court merely followed the conclusion of the Patent Office that as between Faure and Brush, Brush was *de jure* the first inventor. There is no indication of any attempt to introduce any fact testimony with respect to conception and actual reduction to practice of the inventions abroad in contradistinction to mere reliance on Faure's foreign patent date. These Faure and Brush cases were clearly distinguished by Judge Dallas in **Hanifen v. E. H. Godshalk,** 78 Fed. 811 (pgs. 812, 813) on the ground that where the contest was one of priority of invention as between Brush and Faure the Patent Office rule should be followed, whereas on the other hand, under Section 4886 where the alleged anticipatory knowledge and use is not being advanced as the basis for patent rights inuring to such user, the plaintiff patentee is permitted to show that he is *defacto* the first inventor when the validity of his patent is attacked by an infringer. Thus, in the **Hanifen v. E. H. Godshalk** case, supra, Judge Dallas correctly made this finding (page 814):

> "It was competent for the complainant to prove the actual date with reference to the invention made in England."

In the instant case, **the fact that Hall (and consequently petitioner) disclaimed the broad claims following their final defeat in the interference is conclusive against allowing petitioner to claim that there is now in fact any contest of priority between rival claimants for the same patent rights here involved.**

Again, the two cases of **Vacuum Engineering Co.** v. **Dunn,** 209 F. 219, C. C. A. 2 and **Patents Selling & Exporting Co.** v. **Dunn,** 213 F. 40, C. C. A. 2 should be considered together. In the former, suit was brought on the Locke and Dunn patent, and the Schiodt patent was set up as a defense. Schiodt having made his invention in a foreign country, the Court held that knowledge of the

Schiodt invention abroad could not be used because its effect would be to defeat the Locke and Dunn patent prohibited under R. S. 4923. No such condition exists in the instant case as Shimadzu is not attempting to defeat Hall's patent. In the second of these cases suit was brought on the Schiodt patent, and having previously held in the first of these cases that Locke and Dunn were prior to Schiodt, the Locke and Dunn patent was treated as prior art to Schiodt. Thus these two cases again involved, in effect, a contest of priority between Locke and Dunn and Schiodt, and the Court first upheld the Locke and Dunn patent against the attack thereon based on Schiodt's foreign work as required by R. S. 4923. It is important to note that the Second Circuit Court of Appeals in the **Patent Selling & Exporting Co. v. Dunn, supra,** on a motion to amend the mandate stated that it could be amended without prejudice "to introduce further proofs as to priority of invention" when the case was remanded. Again, attention is called to the fact that ultimately a petition to recall the mandate in the first Dunn case, **Vacuum Engineering Co. v. Dunn, supra,** was allowed by the Second Circuit of Appeals reported in 218 Fed. 991.

In **Jay v. Weinberg,** 250 F. 469, D. C. N. D. Ill., the Court held that the Higginson and Arundel patent was entitled to the filing date of the corresponding British application, citing *inter alia* Welsbach v. American and Badische v. Klipstein, supra, which held that a plaintiff patentee, as against an infringer, may prove his work abroad to establish that he is *de facto* the first inventor.

The decision of the court (from which no appeal was taken) in the case of **Ireson v. Pierce,** 39 F. 795, cited by petitioner does not conflict with the foregoing. In the Ireson case no fact testimony relating to the actual development of the invention was introduced. The plaintiff attempted to prove priority of invention over an English patent to Howe not by showing actual facts of the mak-

ing of an invention but merely by reliance upon an English provisional specification. Of course, the same was not "patented or described in any printed publication," (Sections 4886, 4920 and 4923). The Court merely held that the English provisional specification was not a printed publication within the meaning of the statute.

In addition, it is important to note that in the year 1889, the date of the Ireson decision, Section R. S. 4886 did not include the phrase "before his invention or discovery thereof" in specifying the critical date before which an alleged defense of "prior knowledge and use" must be proven nor did it include words limiting the use to one occurring in "this country." These changes in the statute were introduced by amendment of 1897, effective January 1, 1898 (35 U. S. C. A., pages 11, 12).

Moreover, the Second Circuit Court of Appeals in **Welsbach Light Co.** v. **American Incandescent Lamp Co.,** hereinafter more fully discussed, specifically distinguished *inter alia* the Ireson case from its decision on the grounds that the Ireson case related to a contest between original inventors o priority of invention in contradistinction to a suit by a patentee against an infringer. In such a case, the patentee may show the actual and not artificial date of his invention in order to avoid an alleged defense of prior use in this country.

Group (B) Cases Sustaining Right of Patentee to Defend his Patent by Foreign Fact Testimony Against Attack by Infringer are Not Inconsistent with the Foregoing Cases of Group (A).

The instant case comes under the category of rule (B) cases supra as it is concerned with the right of an inventor to introduce proofs in defense and support of the patents where the invention was made abroad when its validity is attacked by an infringer. He is entitled to prove that he is *de facto* the first inventor as required by R. S. 4886 and as alleged in the oath required of him under R. S. 4892. The cases have uniformly so held.

Hanifen v. **E. H. Godshalk Co.**, 78 F. 811, C. C. E. D. Penn., (reversed on other grounds 84 F. 649, C. C. A. 3); **Hanifen** v. **Price**, 96 F. 435, C. C. S. D. N. Y. (reversed on other grounds, 102 F. 509, C. C. A. 2; and affirmed on certiorari by a divided Court, 186 U. S. 481); **Welsbach Light Co.** v. **American Incandescent Lamp Co.**, 98 F. 613, C. C. A. 2; **Badische Anilin & Soda Fabrik** v. **A. Klipstein & Co.**, 125 F. 543, C. C. S. D. N. Y.; **Claude Neon Lights, Inc.**, v. **Rainbow Light, Inc.**, 47 F. (2d) 345, D. C. E. D. N. Y. A summary of this rule of law is aptly stated by the court in the **Claude Neon** v. **Rainbow Light** case last referred to; that court stated, 47 Fed. (2nd) 345, 346, as follows:

> "The plaintiffs have the right as against an infringer to carry the date of invention of the patent in suit back of its convention date by proof of acts abroad.
>
> "Section 4886 of the Revised Statutes of the United States, now title 35, §31, U. S. Code (35 USCA §31), relating to the grant of patents, reads as follows: (quoting statute).
>
> "That statute is not limited to inventions made in the United States. See Walker on Patents (6th Edition) §109, p. 136):
>
> "'When a patent is questioned in point of novelty, and when that question depends upon the date of the invention claimed in that patent, it is not material whether the event, which constituted that invention, occurred in the United States or in some other country.' Welsbach Light Co. v. American Incandescent Lamp Co. (C. C. A.) 98 F. 613, at page 615; Hanifen v. E. H. Gotdshalk Co. (C. C.) 78 F. 811, at page 812; Hanifen v. Price (C. C.) 96 F. 435, at pages 440 and 441; Badische Anilin & Soda Fabrik v. A. Klipstein & Co. (C.C.) 125 F. 543; Hanifen v. Price (C. C. A.) 102 F. 509.

"Defendant's comment on the two Hanifen cases cited, that they were decisions of District Courts and both were reversed upon appeal, does not convince me that they incorrectly state the law, for the reason that such reversals were on other grounds; and, while it is true that in one of the two cases the District Judge reversed himself on rehearing, he did not reverse his former ruling that the patentee of the patent in suit had the right to carry his date of invention back to the date of his inventive act.

"Welsbach Light Co. v. American Incandescent Lamp Co., supra, and Badische Anilin & Soda Fabrik v. A. Klipstein & Co., supra, do support the plaintiff's view, because, even if the comment in the Welsbach Case was obiter, the decisions show that the plaintiffs may carry the date of invention in a foreign country back of the date of convention, even if in the two cases last cited the date was only carried back to the filing date in the foreign country."

The Circuit Courts of Appeals Have Announced and Maintained This Sharp Line of Distinction Between the Group (A) and Group (B) cases.

In distinguishing the type of case here involved from the type of case involving an issue of priority, the Court of Appeals of the Second Circuit in **Welsbach Light Co. v. American Incandescent Lamp Co., supra,** said (page 615):

"This is not the case of an interference in the Patent Office, or of a contest in the courts between two original inventors for priority of invention, in which it is the established rule, under section 4923, Rev. St. U. S., that an original inventor, who applies for letters patent of the United States, cannot be deprived of his right to a patent by the fact that an inventor had made in a foreign country, at a prior

date, the same original invention, but which had not been described at a prior date in a patent or in a printed publication."

After quoting R. S. 4886, the Court said:

"The theory of the defendant is that, as to the domestic inventor, knowledge in this country must precede the actual date of the invention, but that, as to a foreign inventor, knowledge in this country need only precede the date of the publication of his foreign patent. We are of opinion that the language of the section refers to the actual, and not an artificial, date, and that, where there is no contest between inventors, if knowledge in this country did not precede the actual date of the invention, unless it had been used in this country for two years before the application, the inventor was entitled to a patent."

This principle was followed and applied in **Badische** v. **Klipstein, supra** (page 552), and in **Claude Neon Lights** v. **Rainbow Light, supra** (page 346).

In **Hanifen** v. **Price, supra,** the Court after noting the rule to be applied in interference practice said: (p. 441)

"There is, however, a distinction between the provisions of section 4923, which provides for the protection of the patentee against proof of prior knowledge, or use of his invention without publication in a foreign country, and the general grant by section 4886 of the right to a patent to any person who has made an invention not known or used by others in this country, and nowhere patented or described in any printed publication."

After quoting from R. S. 4886, the Court continued:

"The natural interpretation of this language would indicate an intention to confer the benefit of the patent law upon any individual who could show

a prior completed inventive conception, regardless of the place where the invention was conceived *. There is no expressed limitation as to time or place of invention, or of citizenship of the inventor, so far as his rights under section 4886 are concerned."**

Thus, respondents strenuously urge that petitioner has cited no cases nor have respondents been able to find any showing any conflict with this rule which was followed in the Courts below. On the contrary, there is a recognition by the Courts of two different rules which govern two different sets of facts, and petitioner's real complaint, therefore, is that the Courts below have found the facts to be within one rather than the other of the two rules and, in applying the applicable rule, upheld the patents.

POINT II

In failing to find that there was a prior "public use" of the inventions here in issue within the meaning of R. S. 4886 and R. S. 4887 the Courts below have not decided a federal question in conflict with applicable decisions of this Court or a Circuit Court of Appeals.

The facts of the record completely fail to prove any statutory bar of "public" use. However, at the outset we desire to point out that petitioner did not plead in its answer any such defense, nor did it serve notice of this defense as required under R. S. 4920. The failure to comply with the statutory prerequisites should prevent petitioner from urging this belated defense. **Angle et al v. Richardson,** 19 Fed. Sup. 1002, 1004. In any event this Court has denied certiorari under these circumstances. **The Byrne Manufacturing Company v. American Flange & Manufacturing Co., Inc.,** 58 Sup. Ct. 18.

The question of prior use in this case is one of fact which, having been resolved in respondents' favor by concurrent findings of the courts below, is not properly a ground of review by this petition in this court. In **Gen-**

eral Talking Pictures Corp. v. **Western Electric Co., et al, 304 U. S.** 175, 178-179, this Court stated:

> "Granting of the writ would not be warranted merely to review the evidence or inferences drawn from it. **Southern Power Co.** v. **N. C. Public Service Co.,** 263 U. S. 508. **United States** v. **Johnston,** 268 U. S. 220, 227. Moreover, the decision on that point rests on concurrent findings. They are not to be disturbed unless plainly without support. **United States** v. **Chemical Foundation,** 272 U. S. 1, 14. **United States** v. **McGowan,** 290 U. S. 592. **Alabama Power Co. v. Ickes,** 302 U. S. 464. There is evidence to support them. Nor would the writ be granted to review the questions of anticipation and invention that petitioner argues, for as to them there is no conflict between decisions of circuit courts of appeals. **Layne & Bowler Corp.** v. **Western Well Works,** 261 U. S. 387, 393. **Keller** v. **Adams-Campbell Co.,** 264 U. S. 314, 319-320. Cf. **Stilz** v. **United States,** 269 U. S. 144, 147-148."

Petitioner's claim that the lower court's simultaneous holding with respect to petitioner's "Hardinge mill" activities in 1921 and with respect to the validity of patents in suit constitute a conflict with applicable decisions of this Court is unwarranted because the lower courts, from a consideration of the entire record, concurrently found that no such use existed within the meaning of Sections 4886 and 4887. Petitioner's activities with the "Hardinge mill" being of an experimental nature were properly regarded by the lower courts as not constituting a public use in accordance with the rule of this Court enunciated in the case of **Elizabeth** v. **Pavement Company,** 97 U. S. 126, 134, 135.

Petitioner's process was developed in its plant by its engineer Hall. In his applications for United States patents (P. X. 17, 18) which he filed in March, 1924, and in his preliminary statements filed in the Hall-Shimadzu

interference (P. X. 41, pp. 13, 14 and 18), Hall swore that the inventions had not been in public use for more than two years prior to his filing date. Hence, petitioner, who is in privity with Hall, obviously cannot now contend that the inventions were in public use in 1921.

The Courts below in refusing to find prior "public use" and in sustaining the patents have not decided any questions in conflict with applicable decisions of this Court or other Circuit Courts of Appeals. None of the cases cited in petitioner's brief under Point II sustains petitioner's contentions. On the contrary, those cases sustain the proposition that if an invention is publicly used for more than two years prior to the filing date of an application for a patent, such use is a bar to the issuance of a patent thereon. Respondents have no quarrel with the principles expounded in those cases.

None of the authorities cited by the petitioner sustains the proposition that where there are concurrent findings in the courts below on an issue of fact, such as prior "public use," such decisions are open to review in this Court. In all of the cases cited, this Court merely affirmed the findings of the Courts below on this question. No possible conflict, therefore exists between the instant case and these cited decisions.

POINT III

Suppression of inventions during which intervening rights have accrued warranting estoppel against Shimadzu to prove true dates of invention not shown and there is no conflict as to the law applicable.

In connection with the facts relied upon by petitioner stated in Point III, attention is called to the fact that such alleged defense was not pleaded in petitioner's answer nor urged in the trial court. Hence, respondents' arguments under Point II with respect to petitioner's failure to plead public use apply with equal force against petitioner's Point III.

Shimadzu made no suppression of the inventions but subsequent to his reduction to practice in August, 1919 he installed new mills, built a new plant and therein was continually further improving the commercial and economic efficiency thereof up until 1924 as shown by Ishimura's Notebooks (P. X. 7 and 8).* Simultaneously with this commercial activity Shimadzu filed applications in Japan and many other countries in the world on various stages and features which he believed patentable. Thus, on December 17, 1920, he filed in the United States application Serial No. 431, 473, and it is important to note that the United States Patent Office allowed him to state in the specification of the '150 patent that such application was "a continuation in part of application Number 431,473, filed December 17, 1920." The application for patent No. 1,584,149 was filed January 30, 1922, while the application for Shimadzu patent No. 1,584,479 was filed February 20, 1923. It is also important to note that the application 431,473 filed December 17, 1920, was co-pending and overlapping with the filing of the application for patent 1,584,479 filed February 20, 1923, and patent 1, 584,150 filed July 14, 1923. Certainly this activity, both from a commercial aspect and from an attempt to obtain patents, could not be described as any deliberate suppression of the inventions in issue.

The question of suppression by respondent Shimadzu is one of fact. Both of the Courts below concurrently resolved this issue in respondents' favor and is therefore not properly a question for review in this Court on certiorari. **General Pictures Co. v. Electric Co.,** 304 U. S. 175, 178, 179.

Hence, the facts and findings do not support petitioner's charge of suppression. The statements made by this Court in **Kendall v. Winsor,** 21 How. 322, 328, referred to by petitioner, instead of supporting petitioner's contention, actually show that Shimadzu acted wholly

* Translations (Exs. 7a + 8a)

within the latitude of law allowed in connection with filing of patent applications. In that case, this Court stated:

> "But the relation borne to the public by inventors, and the obligations they are bound to fulfill in order to secure from the former protection, and the right to remuneration, by no means forbid a delay requisite for completing an invention, or for a test of its value or success by a series of sufficient and practical experiments; nor do they forbid a discreet and reasonable forbearance to proclaim the theory or operation of a discovery during its progress to completion, and preceding an application for protection in that discovery. The former may be highly advantageous, as tending to the perfecting the invention; the latter may be indispensable, in order to prevent a piracy of rights of the true inventor."

CONCLUSIONS

The decision below is unquestionably correct. It rests upon well settled principles of law entirely in harmony with applicable decisions of this Court.

The questions presented by the petition are almost exclusively questions of fact limited to this particular case. No question of general importance is involved. There is no conflict between Circuit Courts of Appeals on the patents in suit. The lower court has decided no important federal question in conflict with any of the decisions of this Court or any other Circuit Courts of Appeals; nor has it decided any federal question requiring settlement by this Court. On the contrary, the lower court's decision follows the settled practice.

The petition for writ of certiorari should be denied.

Respectively submitted,

EDMUND B. WHITCOMB,
GEO. WHITEFIELD BETTS, JR.
Counsel for Respondents.

Dated: November 18, 1938

APPENDIX

Containing Revised Statutes 4886 (U. S. C., Title 35, sec. 31); 4887 (U. S. C., Title 35, sec. 32); 4892 (U. S. C. Title 35, sec. 35); 4920 (U. S. C., Title 35, sec. 69); 4923 (U. S. C., Title 35, sec. 72):

Section 31. Inventions Patentable.

Sec. 4886. Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, or who has invented or discovered and asexually reproduced any distinct and new variety of plant, other than a tuber-propagated plant, not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor.

Section 32. Inventions Previously Patented Abroad

Sec. 4887. No person otherwise entitled thereto shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented by the inventor or his legal representatives or assigns in a foreign country, unless the application for said foreign patent was filed more than twelve months, in cases within the provisions of section forty-eight hundred and eighty-six of the Revised Statutes, and six months in cases of designs, prior to the filing of the application in this country, in which case no patent shall be granted in this country.

An application for patent for an invention or discovery or for a design filed in this country by any person who has previously regularly filed an appli-

cation for a patent for the same invention, discovery, or design in a foreign country which, by treaty, convention, or law, affords similar privilege to citizens of the United States shall have the same force and effect as the same application would have if filed in this country on the date on which the application for patent for the same invention, discovery, or design was first filed in such foreign country, provided the application in this country is filed within twelve months in cases within the provisions of section forty-eight hundred and eighty-six of the Revised Statutes, and within six months in cases of designs, from the earliest date on which any such foreign application was filed. But no patent shall be granted on an application for patent for an invention or discovery or a design which had been patented or described in a printed publication in this or any foreign country more than two years before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country for more than two years prior to such filing.

Section 35. Oath of Applicant.

Sec. 4892. The applicant shall make oath that he does verily believe himself to be the original and first inventor or discoverer of the art, machine, manufacture, composition, or improvement, or of the variety of plant, for which he solicits a patent; that he does not know and does not believe that the same was ever before known or used; and shall state of what country he is a citizen. Such oath may be made before any person within the United States authorized by law to administer oaths, or, when the applicant resides in a foreign country, before any minister, charge d'affaires, consul, or commercial agent holding commission under the Government of

the United States, or before any notary, public judge, or magistrate having an official seal and authorized to administer oaths in the foreign country in which the applicant may be, whose authority shall be proved by certificate of a diplomatic or consular officer of the United States.

Section 69 Pleading and Proof in Action for Infringement.

Sec. 4920. In any action for infringement the defendant may plead the general issue, and having given notice in writing to the plaintiff or his attorney thirty days before, may prove on trial any one or more the following special matters:

First. That for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect; or,

Second. That he had surreptitiously or unjustly obtained the patent for that which was in fact invented by another, who was using reasonable diligence in adapting and perfecting the same; or,

Third. That it has been patented or described in some printed publication prior to his supposed invention or discovery thereof, or more than two years prior to his application for a patent therefor; or,

Fourth. That he was not the original and first inventor or discoverer of any material and substantial part of the thing patented; or,

Fifth. That it had been in public use or on sale in this country for more than two years before his application for a patent, or had been abandoned to the public.

And in notices as to proof of previous invention, knowledge, or use of the thing patented, the defendant shall state the names of the patentees and the dates of their patents, and when granted, and the names and residences of the persons alleged to have invented or to have had the prior knowledge of the thing patented, and where and by whom it had been used; and if any one or more of the special matters alleged shall be found for the defendant, judgment shall be rendered for him with costs. And the like defenses may be pleaded in any suit in equity for relief against an alleged infringement; and proofs of the same may be given upon like notice in the answer of the defendant, and with the like effect.

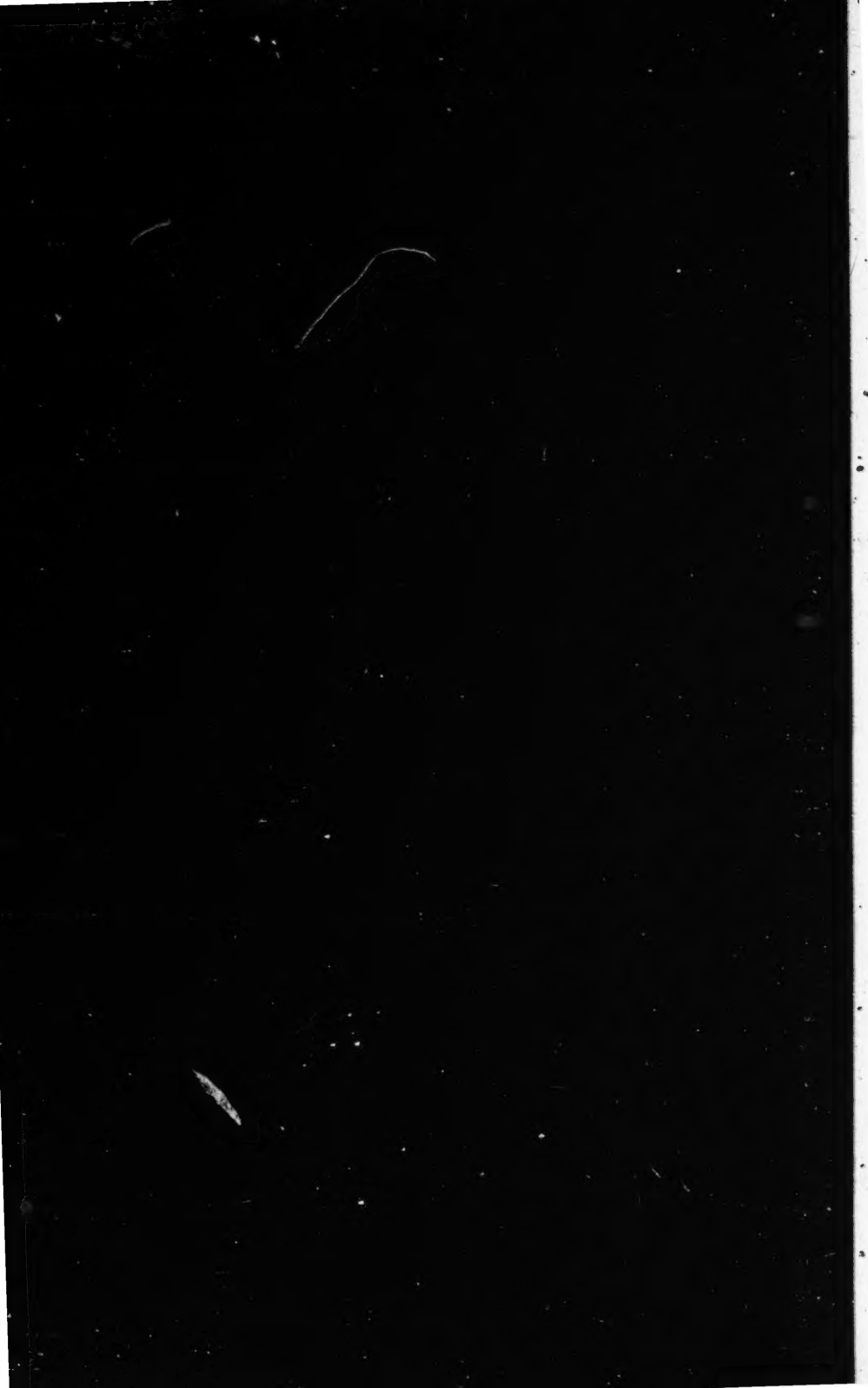
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Section 72. Patent Not Void for Previous Use of Thing in Foreign Country

Sec. 4923. Whenever it appears that a patentee, at the time of making his application for the patent, believed himself to be the original and first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery, or any part thereof, having been known or used in a foreign country, before his invention or discovery thereof, if it had not been patented or described in a printed publication.



The Wilkinson-Sloat Printing Co.,
1217 Jackson St., Toledo, O.



IN THE

Supreme Court of the United States

No. 441, October Term, 1938.

THE ELECTRIC STORAGE BATTERY CO.,
Petitioner.

vs.

GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION,
Respondents.

BRIEF FOR RESPONDENTS

EDMUND B. WHITCOMB,
GEO. WHITEFIELD BETTS, JR.
Counsel for Respondents.

INDEX

	Page
Opinions Below	1
JURISDICTION	2
STATEMENT OF THE CASE	3
SUMMARY OF ARGUMENT	6
ARGUMENT	8
POINT I	8
Under All the Pertinent Patent Statutes, it is Clear that a Patentee as Against an Infringer May Prove Acts Done in a Foreign Country to Antedate an Alleged Prior Use in This Country Where There Is No Contest as to Priority for the Patent Rights to the Same Invention	8
History of Changes in Pertinent Sections of Patent Statutes Clearly Supports Concurrent Conclusions of the Courts Below that Respondents had the Right to Introduce the Antedating Testimony of Acts Done in a Foreign Country	11
History and Effect of R. S. 4886	11
History and Effect of R. S. 4887	18
Effect of R. S. 4892	22
Effect of R. S. 4920	23
Respecting Certain of Petitioner's Contentions, Respondents Submit	24

Page

Respondents' Position Is Not Based on a Mere Altruistic Theory that the United States Should Allow Persons All Over the World to Obtain Patents Here But, on the Contrary, by so Doing the American Public and Industry Has and Will Continue to Profit Thereby 29

It is Well Settled that a Domestic Inventor May Introduce Fact Testimony to Establish His Dates of Invention 32

Conclusion Point I 33

POINT II 38

(1) Suppression and Concealment of Invention Were Neither Pleaded by the Petitioner in the Answer nor Urged Before Either the District Court or the Circuit Court of Appeals; Therefore Such Alleged Defenses Not Properly Before This Court 38

(2) In any Event the Record Fails to Show any Suppression or Concealment by Shimadzu of His Inventions During Which any Intervening Rights Accrued So as to Warrant Invalidating His Patents 39

POINT III 46

The Concurrent Holdings by the Courts Below of Validity of the Patents in Suit Should Not be Disturbed Irrespective of Petitioner's Alleged "Public Use" 46

(1) Admittedly There Can be no Such Defense Against Patent No. 1,584,149 46

(2) The Defense of Alleged Public Use Was Not Properly Pleaded and Therefore that Question is Not Open to This Court 46

Page

(3) Both Lower Courts Having in Effect Found That the Inventions of the '150 and '020 Patents Were Not in Public Use Within the Meaning of R. S. 4886 by Holding Said Patents Valid Have Resolved a Question of Fact in Respondents' Favor Which has Unquestionable Support by the Record and Should Not be Disturbed Here 49

(4) There is Ample Evidence to Support the Concurrent Findings Below, in Fact the Record Clearly Establishes that the Inventions in Suit Were Not in Public Use for More than Two Years Prior to the Actual Filing of the Application for the '150 Patent nor for the '020 Patent Which is Entitled to the Same Filing Date 50

(5) There is No Proof of Public Use of the Process as Distinguished from the Product 53

(6) Hall's Oaths in His Patent Applications and Preliminary Statements Executed Prior to this Litigation Estop Defendant From Claiming "Public Use" Based on Identical Activities Referred to in Said Oaths 58

CONCLUSION 61

APPENDIX ..... a

Authorities Cited

Page

Abrahams v. Universal Wire Co., Inc., 10 Fed. (2d) 838, 842 47

Angle v. Richardson, 19 Fed. Supp. 1002, 1004 47

Badische Anilin & Soda Fabrik v. A. Klipstein & Co., 125 F. 543 37

Barber v. Otis Motor Sales Co., 265 Fed. 675, 679 33

Bates v. Coe, 98 U. S. 31, 34 32

Blair v. Oesterlein Co., 275 U. S. 220, 225 7

Brown v. Duchesne, 19 How. 183 29

The Byrne Manufacturing Company v. American Flange & Manufacturing Co., Inc., 58 Sup. Ct. 18 47

Claude Neon Lights, Inc., et al., v. Rainbow Light, Inc., 47 F. (2d) 545, 346 ..... 17, 37

Cline Electric Mfg. Co., et al., v. Kohler, 27 Fed. (2d) 638, Certiorari denied, 49 S. Ct. 82 55

DeKando v. Armstrong, 37 App. D. C. 314, 319 17

Dewey v. United States, 178 U. S. 510, 521 14

Downton v. Yeager Milling Company, 108 U. S. 466, 471, 477 29

Duignan v. United States, 274 U. S. 195, 200 7

Eibel Process Co. v. Minneapolis & Ontario Paper Co., 261 U. S. 45 50

Electric Storage Battery Co. v. Shimadzu, et al., 98 F. (2d) 831 36

Page

Elizabeth v. Pavement Co., 97 U. S. 126 .....7, 33, 54, 55

Ex Parte Grosselin, 97 O. G. 2977, C. D. (1901) 248, 256 .....27, 28

Gayler v. Wilder, 10 How. 477, 497 .....15, 16

General Talking Pictures Corp. v. Western Electric Co., et al., 304 U. S. 175, 178, 179, 183 .....2, 7, 27, 40, 42, 49

Hali v. Shimadzu, 59 F. (2d) 225 6

Hanifen v. E. H. Godshalk Co., 78 F. 811 .....27, 33, 37

Hanifen v. Price, 96 F. 435 27

Ireson v. Pierce, 39 Fed. 795 25

Keller v. Adams-Campbell Co., 264 U. S. 314, 319 3

Kendall v. Winsor, 21 How. 322, 328 42

Lake County v. Rollins, 130 U. S. 662, 670 14

Loom Company v. Higgins, 105 U. S. 580, 592 33

Milburn Co. v. Davis, et al., Co., 270 U. S. 390, 402 9

Patents Selling & Exporting Co. v. Dunn, 213 F. 40....28

Rebuffat v. Crawford, 68 F. (2d) 980, 982 16

Rosenwasser v. Spieth, 129 U. S. 47, 50, 52 29

Rubber Co. v. Goodyear, 76 U. S. 788, 801 .....7, 39, 48

Page

St. Paul Plow Works v. Starling, 140 U. S. 184, 198 33

Shimadzu, et. al., v. Electric Storage Battery Co., 17 F. Supp. 42 1

Shimadzu, et. al., v. Electric Storage Battery Co., 36 U. S., P. Q. 25 1

Smith v. Barter, 7 O. G. 1, 1875, C. D. 8 16

Spaulding v. Wanamaker, 256 Fed. 530 22

Treat v. White, 181 U. S. 264, 267 14

U. S. v. Dubilier Condenser Corp., 289 U. S. 178, 186 .31

U. S. Rifle and Cartridge Co. v. Whitney Arms Co., 118 U. S. 22 45

Vacuum Engineering Co. v. Dunn, 209 F. 219 28

Victor Talking Machine Co. v. Starr Piano Company, 281 Fed. 60 44

Walker on Patents, Sixth Edition, pgs. 115, 116 23

Webster Co. v. Splitdorf Co., 264 U. S. 463 45

Webster's New International Dictionary, Second Edition, Unabridged, 1936 51

Welsbach Light Co. v. American Incandescent Lamp Co., 98 F. 613 .....27, 37

Wilson, et. al., v. Sherts, et. al., 81 F. (2d) 755 16

Wirebounds Patents Co. v. Saranac Automatic Mach. Corp., 65 Fed. (2d) 904 44

Woodbridge v. U. S., 263 U. S. 50 45

Statutes and Miscellaneous Citations

Page

Congressional Record, February 16, 1903, p. 2275 30

Judicial Code, §240 (a) 2

Nolan Act 24

Patent Act of 1790 (1 Stat. 109, §1) 11, 12

Patent Act of 1793 (1 Stat. 318, §1) 11, 12, 6-a

Patent Act of 1800, §1 .....11, 12, 6-a

Patent Act of 1836 (5 Stat. 117) §6, §15 .....
..... 11, 12, 13, 7-a, 9-a

Patent Act of 1870 (16 Stat. 198) §24, §25 ....13, 8-a, 10-a

Patent Act of 1897 (29 Stat. 692) 13, 8-a, 11-a

Patent Act of 1903 .....11-a

R. S. 4886 .....10, 11, 12, 17, 18, 26, 37, 38, 55, 1-a, 6-a

R. S. 4887 .....18, 19, 29, 1-a, 2-a, 9-a, 10-a, 11-a

R. S. 4892 .....17, 22, 2-a, 3-a

R. S. 4915 24

R. S. 4918 24

R. S. 4920 .....17, 23, 46, 47, 3-a

R. S. 4923 .....8, 9, 17, 26, 35, 37, 4-a, 12-a

Rule 126 of the Rules of the United States Patent Office (Appendix) 5-a

IN THE

Supreme Court of the United States

No. 441, October Term, 1938.

THE ELECTRIC STORAGE BATTERY CO.,
Petitioner,

vs.

GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION,
Respondents.

On Writ of Certiorari to the United States Circuit Court of Appeals for the Third Circuit.

BRIEF FOR RESPONDENTS

Opinions Below

The opinion of the District Court for the Eastern District of Pennsylvania (R. II, 1162-1189) is reported in 17 F. Supp. 42. A supplemental opinion of the District Court, not included in the record filed by petitioner, is reported in 36 U. S. P. Q. 25. The opinion of the Court of Appeals for the Third Circuit is reported in 98 F. (2d) 831.

JURISDICTION

While jurisdiction in this Court is invoked under the Judicial Code, §240 (a), as amended, respondents respectfully submit that there was no real ground for the application for certiorari in this case for the following reasons:

(1) As to petitioner's point I, there is no conflict in the ruling of Federal Courts permitting a foreign inventor to take antedating testimony of acts abroad in a suit for infringement not involving a contest of priority for the same invention[1]. Hence there is no unsettled point of law requiring determination by this Court.

(2) As to petitioner's Points II and III, both are mere questions of fact resolved in favor of respondents by concurrent decisions of the Courts below, which were supported by the proofs and hence should not be disturbed. This Court in **General Talking Pictures Corp. v. Western Electric Co., et al.,** 304 U. S. 175, 178, stated:

> "Moreover, the decision on that point rests on concurrent findings. They are not to be disturbed unless plainly without support. United States v. Chemical Foundation, 272 U. S. 1, 14. United States v. McGowan, 290 U. S. 592. Alabama Power Co. v. Ickes, 302 U. S. 464."

Furthermore, as to Points II and III, there is no conflict on the same patent between different Circuit Courts of Appeals.

---

[1]This suit is against petitioner as an infringer. After the Hall-Shimadzu interference decided adversely to Hall (petitioner's engineer) 59 Fed. (2d) 225, Hall accepted limited claims distinguished from this invention.

Under the decisions of this Court, respondents submit the result should be an order in accordance with the following ruling of this Court in **Keller v. Adams-Campbell Co.**, 264 U. S. 314, 320:

> "dismissing the writ of certiorari as improvidently granted at the costs of the petitioner. Layne & Bowler Corporation v. Western Well Works, Inc., 261 U. S. 387; Furness, Withy & Co. v. Yang-Tsze Insurance Association, 242 U. S. 430; United States v. Rimer, 220 U. S. 547."

STATEMENT OF THE CASE

Respondents make the following corrections, exceptions and additions to petitioner's statement of the case. A reading of the claims of the patents in suit will show that they are not all limited to the process being conducted in a dry state, nor did the Courts below make the distinction between the patent No. 1,584,149 and the patent No. 1,584,150 as indicated in petitioner's Foot note 4. The Court stated (R. II, 1167) that patent No. 1,584,149 does not specify the temperature "control" (regardless of temperature at which the mill is operated).

Petitioner's statement on Page 4 of its brief, question (1), that respondents rely on oral evidence is incorrect. They rely as well on the many documentary exhibits, particularly including PX-10, a large drawing of Shimadzu's mill which was not only dated but was acknowledged before a Notary Public in Japan in 1919 (PX-10) and Ishimura's notebooks (PX-7, 7-A, 8, 8-A).

Page 6 of petitioner's brief (7), respondents desire to correct the impression made by petitioner that the

only purpose in introducing the early testimony by Shimadzu was to carry the dates of invention back of June, 1921. The object was to show in particular the difficulties encountered by respondent in making the important inventions of the patents in suit, and the history thereof, and to establish Shimadzu's real date of invention for all purposes. At that time respondents knew nothing of any alleged importance of the date of June, 1921.

Respondents also desire to point out that petitioner's statement with respect to witnesses Cooper and Nagle, Page 8 of its brief (11), is not accurate, as Cooper entered and left petitioner's employ after the critical period (1921), and Nagle was employed while Cooper was there. There is no evidence as to when he entered or left petitioner's employ.

The petitioner pleaded several defenses under R. S. 4886, including prior knowledge and use by others in this country before Shimadzu's inventions and that Shimadzu was not the first inventor of the subject matter of the patents in suit. Notwithstanding statements to the contrary, petitioner did not plead a prior **"public use"** based on its operation of its Hardinge Mill for more than two years prior to the filing of the applications of the patents in suit (R. I, 28-44).

Likewise, the record in this case does not disclose that petitioner pleaded suppression and concealment of these inventions, much less suppression and concealment vis-a-vis persons in the United States, nor do the opinions of the Courts below reveal any definite finding on this alleged issue.

Respondents introduced evidence at the trial to show that Shimadzu conceived and reduced the inventions to practice in Japan earlier, and the Courts below found this to be not later, than August, 1919 (R. II, 1166). While the petitioner objected to such evidence, the Courts below held that the respondents were "undoubtedly entitled to rely for priority upon the date of invention and reduction to practice as found, regardless of the fact that the invention was made in a foreign country." (R. II, 1178.)

While the petitioner quotes the statement by the Courts below with respect to the commercial production by the Hardinge Mill in 1921, attention is also called to the fact that both lower Courts were careful not to find such use to be a "public use".

The Hall process, employing the Hardinge Mill, which petitioner contends it has been using since 1921, and thus that it constitutes prior knowledge and use, as well as an alleged prior "public use" of the respondents' inventions was the subject matter of bitterly contested interference proceedings in the Patent Office for several years prior to the commencement of the present suit. Hall, petitioner's engineer, who under its direction conducted the various experiments with this process since 1921 in petitioner's plant, did not file an application for a United States patent until March 29, 1924. In this patent application (PX-17, 18) and in two preliminary statements in the interferences (PX-41, pgs. 29, 32, 259). Hall swore that these identical actions were not a "public use" more than two years prior to his application.

The Patent Office tribunals and the Court of Customs and Patent Appeals uniformly held that Hall had failed to establish conception or reduction to practice of the counts of the interference prior to the filing date of Shimadzu's patent No. 1,584,150, which was July 14, 1923, and awarded priority to respondent Shimadzu. (Hall v. Shimadzu, 59 Fed. (2d) 225.)

SUMMARY OF ARGUMENT

As to Point I, respondents respectfully submit that under all the pertinent patent statutes and the authorities, a patentee as against an infringer is clearly entitled to prove acts done in a foreign country to antedate an alleged prior use in this country where there is no contest as to priority for the patent rights to the same invention.

(1) A contest of priority of invention between rival claimants for the same patent rights has a different status in the law and is governed by different rules and principles than those governing the rights of a patentee to establish that he is in fact the first inventor to overcome the defense of prior knowledge and use in this country as against an infringer urging the same.

(2) The history and construction of the pertinent sections of the patent statutes and the authorities support the concurrent conclusions of the Courts below that respondents had the right to introduce proofs of inventive acts in a foreign country.

In connection with Point II, respondents submit--

(1) That the alleged issues of suppression and concealment were presented neither by the pleadings nor the proofs at the trial, nor were they mentioned on the argu-

ment nor in petitioner's briefs before the District Court nor in the Circuit Court of Appeals, and cannot therefore be properly raised here for the first time. **Rubber Co. v. Goodyear,** 76 U. S. 788, 801; **Duignan v. United States,** 274 U. S. 195, 200; **Blair v. Oesterlein Co.,** 275 U. S. 220, 225.

(2) That from the proofs submitted on other points, however, the record shows that there was no concealment, suppression or abandonment of the inventions by Shimadzu.

In connection with Point III, respondents submit:

(1) That the alleged public use, based on petitioner's 1921 Hall activities, was not only not pleaded but particularly avoided in the pleadings by petitioner;

(2) That the proofs in this case show:

(a) The alleged use was not "public" within the meaning of the statute, R. S. 4886;

(b) Petitioner's alleged use was certainly experimental even though on a commercial scale under the doctrine of this Court in the case of **Elizabeth v. Pavement Co.,** 97 U. S. 126, until so long subsequent to the critical date as to render this belated defense of no avail;

(c) Petitioner is estopped by the three oaths made in Hall's application and in the interferences from now claiming that the identical activities affirmed at that time under oath not to have been in public use, constitute such a use;

(3) A question of "public use" being one of fact, and both lower Courts herein having found the patents in suit valid, these concurrent holdings should not be disturbed here as there is ample proof for the support of the same. **General Talking Pictures Corp. v. Western Electric Co., et al.,** 304 U. S. 175, 178, 179.

ARGUMENT.

POINT I

Under All the Pertinent Patent Statutes, it is Clear that a Patentee as Against an Infringer May Prove Acts Done in a Foreign Country to Antedate an Alleged Prior Use in Th' Country Where There is no Contest as to Priority for the Patent Rights to the Same Invention.

A consideration of the brief presented by the petitioner indicates that petitioner has failed to distinguish between true contests of priority in which rival claimants are attempting to secure patent rights covering the same invention, and the issue which arises when, in an infringement suit, the defendant alleges that the patentee of the patent in suit was not the first inventor. These two situations are entirely different and are properly governed by different rules of law. In the first situation, the interests of the public are served equally well irrespective of to whom the patent is ultimately awarded. The struggle is merely between two or more aspirants for the rights to a monopoly. The Courts, in construing R. S. 4923, have held in effect that in this situation, a domestic inventor should be given a preference to the extent that knowledge and use of his invention in a foreign country prior to the date of his invention should not operate to prejudice his rights.[2] The purpose of

[2] All the cases referred to by petitioner and all others known to respondents base the fundamental reason for this policy of law upon the wording of R. S. 4923, which is limited to cases where it is necessary to protect "the thing patented" (or about to be patented) as clearly specified in that section. It has no application whatever to the facts of the instant case,—especially where the activities constituting the alleged prior use now relied upon by petitioner were first sought to be patented, but by amendment in the Patent Office, Hall (and hence petitioner) accepted limitations, thereby becoming forever estopped to claim patent rights to the inventions patented to respondent.

R. S. 4886 and R. S. 4923 in excluding from the statutory bars knowledge and use in a foreign country is to bestow such preference upon domestic inventors. The reason for this rule is obvious. It would be unjust to penalize an inventor in this country who in good faith devoted his time and energy to the making and perfecting of an invention and then by denying him the right to a patent by reason of the existence of an unpublished, unavailable knowledge or use of his invention in some foreign country.

Manifestly, this situation is entirely different from that of a patentee against whose patent an infringer has alleged as a defense that the patentee is not the first inventor of the subject matter of the patent, and that the invention was known or used in this country prior to the date upon which it was made by the patentee. In this latter situation, there is no rival claimant for the right to the patent. Therefore there is no one to receive the preference which is given to domestic inventors under R. S. 4923. Public interest is not here involved as the patentee has already made a full disclosure of his invention in the application and patent to the public under a contract whereby it will become public property at the expiration of seventeen years from the date of the patent. To be eligible to obtain a patent, a person must be a first inventor. **Milburn Co. v. Davis etc. Co.**, 270 U. S. 390. If the validity of his patent is attacked on the ground that he was not in fact the first inventor, he should be entitled to overcome allegations to that effect by establishing the date of his invention. It would be absurd indeed to say that, in order to obtain a patent, a person must

comply with certain definite requirements and, after he has obtained his patent, to deny to him the right to establish that he had complied with the required conditions, if at any time his compliance were challenged. The explicit wording of R. S. 4886, as well as sound logic, gives to the patentee the right to meet all such challenges by establishing and relying upon his actual date of invention irrespective of where made.

If this distinction is borne in mind the issue intended to be raised by petitioner under its caption, Point I, becomes clear and simplified. It becomes apparent at once that the sole question presented is covered by R. S. 4886.

Petitioner's Point I is stated much more broadly than is warranted by any issue presented in this case. The precise question for the determination of this Court is whether the phrase "in this country" should be read into R.S. 4886 immediately following the words "before his invention or discovery thereof" (both occurrences) to limit the time and place of invention or discovery. Stated differently, the question is whether R. S. 4886 should be construed as though it read as follows:

> "Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, not known or used by others in this country, before his invention or discovery thereof **(in this country)**, [3] and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof **(in this country)**, [3] or more

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[3] Inserts in Parentheses ours.

than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor."

A brief consideration of the history of the United States Patent Statutes reveals that the inclusion of such words was not intended nor can it be justified.

History of Changes in Pertinent Sections of Patent Statutes Clearly Supports Concurrent Conclusions of the Courts Below that Respondents had the Right to Introduce the Antedating Testimony of Acts Done in a Foreign Country.

History and Effect of R. S. 4886

The Patent Act of 1790 (1 Stat. 109, §1)* authorized the grant of Letters Patent to "any person or persons" who made an invention "not before known or used". However, the Act of 1793 (1 Stat. 318 §1) limited patentees to "a citizen or citizens of the United States". By the Act of 1800, §1, the right to obtain a patent was "extended and given to all aliens who at the time of petitioning in the manner prescribed by said Act, shall have resided for two years within the United States". The Act of 1836 (5 Stat. §6) restored the right to obtain a patent to "any person or persons" without limitation, but specified much higher application fees for citizens of foreign countries than for citizens of the United States. This difference has long since been eliminated

* All pertinent sections of the Patent Statutes are printed in the Appendix.

from the statutes. R. S. 4886 as now in effect still provides that "any person" (without limitation as to citizenship or place of invention) may obtain a patent.

R. S. 4886 further provides, as one condition for obtaining a patent, that the invention shall not have been "known or used by others in this country, before his invention or discovery thereof". The predecessor of this statutory bar originally appeared in the Act of 1790 (1 Stat. 109) and read "not before known or used". §1 of the Act of 1793 (1 Stat. 318) amended this clause to read not "known or used **before the application.**" [5] It is important to note that the Act of 1800, §1, required an applicant to swear that his invention had not "been known or used in this or any foreign country". The Act of 1836, §6, (5 Stat. 117) amended the prior knowledge and use clause to read "not known or used **by others before his invention or discovery thereof**". Thus, the knowledge or use, to constitute a bar to the grant of a patent under the latter act, must have been prior to the date of invention instead of simply the application date. It is important to note that none of the statutes so far referred to imposed any limitation as to the place of invention or discovery. Thus we find this major difference between the Act of 1836 and those that preceded it. By establishing the actual date of invention as the date before which the invention must have been known or used in order to bar the grant of a patent, and by failing to impose limitations as to the place of invention or discovery, Congress extended to inventors

[5] Unless otherwise indicated, emphasis throughout the brief is ours.

the right to rely upon their actual date of invention whether made in the United States or a foreign country to defeat prior knowledge or prior use. Prior to the Act of 1836, neither an inventor in the United States nor an inventor in a foreign country could rely upon his actual date of invention to overcome prior knowledge or prior use because of the statutory provision that such knowledge or use would defeat the patent if it antedated the application date thereof.

However, §24 of the Act of 1870 (16 Stat. 198) expressly limited the prior knowledge or use which would constitute a bar to that occurring "in this country", but significantly failed to impose a similar limitation on the place of "invention or discovery".

The Act of 1897 (29 Stat. 692) effected no change in the substance of this clause. It employed identical, although rearranged, wording, to wit, that other conditions having been met, a patent may be obtained if the invention was "not known or used by others in this country before his invention or discovery thereof". This is the way the clause reads today.

Prior to the Act of 1870 no limitation was placed upon the place where the prior knowledge or use occurred, except that provided for in §15 of the Act of 1836 which required that prior knowledge or use in a foreign country, to constitute a bar to the grant of a United States patent, must be evidenced by a printed publication or a patent. The failure of Congress to amend the statute to limit the place of "invention or discovery" to this country must be accepted as conclusive of the fact that no such limitation was intended or should

be now applied, particularly when it is considered that by the Act of 1870 the place of "knowledge or use" was expressly so limited.

From this history the intent of Congress is clear. The statute is unambiguous and should be given the natural and ordinary meaning. See **Lake County v. Rollins,** 130 U. S. 662, 670; **Treat v. White,** 181 U. S. 264, 267; **Dewey v. United States,** 178 U. S. 510, 521, where this Court stated:

> "Our province is to declare what the law is, and not, under the guise of interpretation or under the influence of what may be surmised to be the policy of the Government, so to depart from sound rules of construction as in effect to adjudge that to be law which Congress has not enacted as such. Here, the language used by Congress is unambiguous. It is so clear that the mind at once recognizes the intent of Congress. Interpreted according to the natural import of the words used, the statute involves no absurdity or contradiction, and there is consequently no room for construction. Our duty is to give effect to the will of Congress, as thus plainly expressed."

What justification can there be, therefore, for construing the present R. S. 4886 as though the time and place of "invention or discovery" were expressly limited to this country?

We therefore see, retracing the history of the statutes, that whereas the early Act of 1790 provided that the critical date of prior knowledge or prior use be the date of the patent application and that at the same time the knowledge or use might be in a foreign country as well as in the United States, in all subsequent amend-

ments thereto the critical date for this Statutory Bar was the inventor's date of discovery or invention thereof regardless of whether the invention was made in the United States or in a foreign country or made by citizens of the United States or by citizens of foreign countries. The history of the amendments to the statutes in which patents were at one time allowed to citizens of the United States only and then to aliens who resided here for two years (but not other foreign citizens) and then to citizens of any country in the world, as the statute today provides, also clearly shows the intent of Congress to open the doors of our patent system to receive inventions made in foreign countries as well as those made in the United States and to grant patents thereon. The only limitation that has been made with respect to acts in the United States compared with acts in a foreign country is that amendment which limited the invalidation of a patent on prior knowledge or use to knowledge or use "by others in this country" before the invention or discovery. The reason for this is given by this Court in **Gayler v. Wilder,** 10 How. 477, 497, where it was pointed out that where this knowledge or use existed only in remote places even for ages "the people of this country would be unable to profit by it. The means of obtaining knowledge would not be within their reach; and, as far as their interest is concerned, it would be the same as if the improvement had never been discovered." It is true that patenting or printing in a publication in any foreign country as well as the United States constitutes a bar if prior to a patentee's date of invention or discovery, or more than two years prior to his application in the

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United States. In other words, patenting or publishing an invention in a foreign country is deemed to make it available to citizens of this country. Likewise, where an inventor makes an invention in a foreign country, whether he be a citizen of the United States or of a foreign country and takes steps by way of filing an application in the United States, he brings it to the United States and this act entitles him to the reward of the patent, all other statutory requirements having been complied with. Hence the principle of law enunciated by this Court in **Gayler v. Wilder,** supra, that in contrast to a mere use in a foreign country, where an inventor files an application in this country and thereby benefits the public of the United States "by the effect of his own genius," he is entitled to a patent and the principle that the law "protects his patent" in such cases applies even stronger to the instant case. Under the principle as enunciated in **Gayler v. Wilder,** supra, by this Court, it is immaterial whether the inventor bringing the invention to the public of the United States makes the invention in the United States or in a foreign country.

Petitioner relies primarily on the Patent Office Interference Practice and cases in court dealing with contests on priority on the same patent rights. If the line of reasoning in all these cases be traced back, it will be found that R. S. 4923 is the fountain from which it flows. See **Smith v. Barter,** (7 O. G. 1, 1875, C. D. 8). In the opinion in the recent case of **Wilson et al. v. Sherts et al.,** 81 F. (2d) 755, the Court of Customs and Patent Appeals refers to its prior decision of **Rebuffat v. Crawford,**

68 F. (2d) 980, 982, 21 C. C. P. A. Patents 901, which in turns refers to one of the fundamental cases of **De Kando v. Armstrong,** 37 App. D. C. 314, 319, which places practically the entire doctrine of excluding foreign knowledge or use in contests for priority on the same patent rights on RS 4923.

Notwithstanding that the Patent Office and the Courts, in determining priority of rights to a single thing patented or to be patented, may have, under the express provisions of RS 4923, limited the proofs which may be introduced to those acts committed in the United States rather than in any foreign country, respondents submit that under the plain wording of the statutes pertinent to the instant issue, particularly RS 4886, 4892 and 4920—especially in view of the history as herein outlined—all the courts have correctly and consistently held that, in an infringement suit, a patentee may introduce facts showing the early dates of invention, even if made in a foreign country in order to antedate a defense of prior knowledge or prior use. A summary of this rule of law is aptly stated by the Court in **Claude Neon Lights, Inc., et al. v. Rainbow Light, Inc.,** 47 F. (2d) 345, 346, as follows:

> "These are two motions for commissions to take testimony abroad.
>
> * * * * *
>
> "The plaintiffs have the right as against an infringer to carry the date of invention of the patent in suit back of its convention date by proof of acts abroad.

Section 4886 of the Revised Statutes of the United States, now title 35, §31, U. S. Code (35 USCA §31), relating to the grant of patents, reads as follows (quoting statute):

"That statute is not limited to inventions made in the United States. See Walker on Patents (6th Edition) §109, p. 136:

"'When a patent is questioned in point of novelty, and when that question depends upon the date of the invention claimed in that patent, it is not material whether the event, which constituted that invention, occurred in the United States or in some other country.' Welsbach Light Co. v. American Incandescent Lamp Co. (C. C. A.) 98 F. 613, at page 615; Hanifen v. E. H. Godshalk Co. (C. C.) 78 F. 811, at page 812; Hanifen v. Price (C. C.) 96 F. 435, at pages 440 and 441; Badische Anilin & Soda Fabrik v. A. Klipstein & Co. (C. C.) 125 F. 543; Hanifen v. Price (C. C. A.) 102 F. 509."

History and Effect of R. S. 4887

RS 4887 relates to patenting and filing of patent applications for the same invention in foreign countries and in the United States. It says not a word about the question before this Court of whether or not the critical date of the statutory bar of prior knowledge or prior use under RS 4886 is limited to the date of acts done in the United States. On the contrary, as we shall hereinafter point out, there is a clear implication in RS 4887 that the same is not intended to so limit RS 4886. Although there is not a word in RS 4887 as to actual dates or facts relating to the creation of an invention, such as conception and actual reduction to practice—let

lone attempting to contrast such acts made in the nited States with those done in a foreign country—etitioner seems to lay great stress on RS 4887 as in-licating an intent on the part of Congress to preclude he right of inventors to show the actual date of an in-ention if made in a foreign country, and to limit the ame to some artificial date such as the filing of the ap-lication. Such contentions completely ignore the mendments to our patent statutes above referred to hanging the critical date of prior knowledge or use, to onstitute a statutory bar, from a mere "application late" to the date of the inventor's "invention or dis-overy thereof"—with no limitation as to whether such nvention is made in the United States or in a foreign ountry.

It is also important to bear in mind that RS 4887 pplies to citizens of the United States who may file an pplication in the foreign country prior to filing the ame in the United States as well as to a citizen of a oreign country filing an application first in a foreign ountry, as this section deals with applications and pat-nts and not with citizenship.

The history of RS 4887 and its predecessor sections equires that only three points be considered: First, he Act of 1870, §25, provided that prior patenting broad might not invalidate a United States patent if pplication be filed within the time specified, provided hat the invention "shall not have been introduced into ublic use for more than two years prior to the applica-on". This provision was eliminated by the Act of 897 and has never reappeared. Second, by the Act of

1903, Paragraph 2 of RS 4887 was added due to reciprocal arrangements with foreign countries. This paragraph primarily gives the "same force and effect" to the filing of an application in a foreign country as if the same application had been filed "in this country on the date on which the application for patent for the same invention, discovery or design was first filed in said foreign country" if the U. S. application is filed within twelve months of the filing date of the foreign application. However, it is important to note that in the last sentence of Paragraph 2, Congress modified the "force and effect" of the application filed in the foreign country so that the statutory bars relating to two years prior patenting or description in a printed publication before the actual filing of the application in this country, and "public use or on sale in this country for more than two years prior to the date of the actual filing" in this country still apply. Contrary to petitioner's contentions, Congress failed to include in this limiting portion of RS 4887 a further limitation which would preclude proof of facts relating to the actual date of an invention made in a foreign country to overcome the prior knowledge or use bar of RS 4886. The fact that, Congress, in limiting the "full force and effect" to be given to a foreign patent application omitted from its delineation of those bars not overcome by the foreign application all reference to the bar of prior knowledge or use is clearly indicative of its intent that no such additional limitation should be imposed. In other words, Congress did not in RS 4887 modify the plain intent of RS 4886—as clearly evidenced by its history as above pointed out.

RS 4887 as amended by the Act of 1903, which is ıbstantially its present form, was dependent upon re- procal relations with foreign countries. In discussing e matter on the floor of the House, (Congressional ecord, Feb. 16, 1903, p. 2275) it was pointed out that:

> "Nearly all of the nations which were represented there (International Convention for the Protection of Industrial Property, held at Brussels in December, 1900) have already passed the necessary legislation to give force to this act. I will read the names of the countries that have already legislated: Belgium, Denmark, France, Great Britain, Italy, Japan, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and Tunis."

is of interest to note that at this same time an amend- ent was made to the old caveat law to permit citizens any country in the world as well as citizens of the nited States to file the proofs of their dates of inven- on in the secret archives of the government in order to ly on them to prove the same as may be necessary. lthough the caveat section, RS 4902, has since been pealed and the factual dates are now proven as facts e proven in any case, it related to establishing priority ghts to inventions prior to filing of formal applications r patent. In pointing out why this rule should apply citizens of foreign countries as well as to citizens of e United States, Congressman Currier stated: (1903 ongressional Record, February 16, p. 2275)

> "We do not discriminate against the citizens of foreign countries in regard to making application for patents, and no reason exists for discriminating against them in the matter of filing a preliminary application."

This preliminary application or caveat, constituted one manner of establishing an actual date of invention earlier than the filing date of an application.

Effect of R. S. 4892

Petitioner has vigorously contended that the patent statutes of the United States fail to take cognizance of acts of any nature which occur in a foreign country, other than those evidenced by patents, printed publications, or applications filed within the purview of R. S. 4887. However, in many instances the United States patent laws take full cognizance of occurrences in a foreign country. For example, R. S. 4892 requires that an applicant for patent "make oath that he does verily believe himself to be the original and first inventor . . .; that he does not know and does not believe that the same was ever before known or used." There is no limitation as to place in respect of either of these allegations. Consider the situation where a citizen of a foreign country who makes an invention abroad has knowledge of a use of his invention either in his country or some country foreign to the United States prior to his earliest date of invention. Under such circumstances the foreign inventor would be unable to obtain a patent in the United States for his invention. He could not make the oath required under R. S. 4892. In this situation, although neither the inventor nor his invention nor the antedating prior knowledge and use thereof ever came within the territorial limits of the United States, the United States patent statutes would absolutely bar the granting of a patent. It was so held in **Spaulding v. Wanamaker**, 256 Fed.

530. Also see **Walker on Patents, Sixth Edition**, pages 115, 116. This is but one instance, many more could be cited but it is not deemed necessary to do so here.

Effect of R. S. 4920

The Fourth paragraph of R. S. 4920 authorizes the special defense that the patentee "was not the original and first inventor or discoverer of any material and substantial part of the thing patented." Reversely stated R. S. 4920 clearly indicates that to sustain a valid patent, the patentee must in fact be "the original and first inventor or discoverer" of the thing patented.

Petitioner tacitly admits that one of the statutory requirements is that a patentee must be the "first" inventor because it positively asserts (page 28 of its brief) that the patentee of the patents here in suit was not "within the meaning of those statutes, the first inventor of his alleged inventions." Hence, if under the statutes the patentee must establish that he is the "first" inventor to sustain his patent, he must be permitted to submit proofs to establish that fact.

It is respectfully urged, therefore, that the question of the propriety of the interference practice, either as conducted in the Patent Office or in the Federal Courts, in a contest of priority of invention between contestants for the same patent rights, is not before this Court, nor is a consideration thereof necessary to a determination of the issues between the parties here, particularly as the patentee Hall accepted limited claims after he was defeated on priority of invention by respondent.

Respecting Certain of Petitioner's Contentions; Respondents Submit That:

The Nolan Act, referred to by petitioner, is not pertinent to the issue here involved. Under the recognized **interference practice** such an act was necessary. Moreover, its provisions are strictly limited thereto by the very wording of the act giving World War service men the benefits of acts done abroad insofar as they relate to "rights of priority with respect of said inventions" in "interference". The "other proceedings" referred to include suits under R. S. 4915 and R. S. 4918, involving interfering patents or interfering patent rights in contradistinction to the "interference proceedings", or the Patent Office practice in interferences.

Petitioner's argument page 17 of its brief that the denial of the effectiveness of foreign knowledge and use is in favor of the general public is offset by the fact that, supplementing the broader statutes, R. S. 4923 limits its application to the specific conditions recited therein, to-wit: that (only) wherever it shall appear that a patentee believed himself to be an original inventor, then and in that event to protect the "thing patented" the foreign knowledge and use shall not render such patent void under the conditions recited. Hence, the prohibition does not have any broader application or apply to the facts of the instant case as we have pointed out.

The suggestion that respondents' position here would lead to the conclusion that the amendment to R. S. 4887 would be a "work of supererogation" is unwarranted. Congress for the first time by the Amendment of 1903 gave the foreign application the same

force and effect as an American application would have as of the date filed in the foreign country. It is well known that one of the "effects" of the filing of an application in United States is a "constructive reduction to practice" of an invention described therein, but this is only one of the several important factors in establishing priority rights of invention such as conception, disclosure, etc. Before the Amendment of 1903, the written description in a foreign application was evidence of a conception, being a written disclosure of the invention. By the Amendment of 1903, Congress increased the legal effect of the filing of an application in a foreign country by giving it the effect of a "constructive reduction to practice" in contradistinction to its value prior to that Amendment as mere evidence of disclosure.

In **Ireson v. Pierce**, 39 Fed. 795, referred to in page 21 petitioner's brief, the plaintiff desired to rely upon a "provisional" British application, and the Court held that it could only admit a "complete" patent under the wording of the statutes referring specifically to R. S. 4923. No attempt whatever was made to show facts abroad such as actual reduction to practice, and hence a broad interpretation of the language used in the Ireson case makes it mere obiter dictum. Moreover, the real reason for the court's decision in the Ireson case is found in its statement that—

> "It has been repeatedly held that an English patent does not exist as a patent for uses, under the sections of the Revised Statutes above referred to, until the enrollment or sealing of the complete specifications, at which time the English patent becomes open to the public."

Contrary to petitioner's contention, page 24 of its brief, that the lower courts herein overlooked the "broad purpose, object and spirit of the patent statutes", the history and plain intent of the pertinent statutes show that the courts below have merely given the foreign inventor the right afforded him under R. S. 4886 to show the actual and not artificial date of his invention in patent infringement suits against infringers. The only possible limitation to that right is R. S. 4923, where an American inventor is claiming the identical right to a patent for the identical invention which is not the case here.

Answering petitioner's argument on pages 26 and 27 of its brief, Hall kept his experiments secret and private until March, 1924, when he attempted to obtain a patent on this identical invention (as to certain claims) thus conclusiyely rebutting any presumption of an intent to donate it to the public.

Again, Shimadzu being the first inventor, as both lower Courts have concurrently held, Hall had nothing to "donate" to the public. Moreover, even if it were conceded that Hall had completed his invention in 1921, his dilatory procedure in waiting until 1924 to file his patent application exposed him to the eventuality which occurred here of another independent inventor (Shimadzu), first applying for patent, the grant of which made the knoweledge available to the American public. Neither Hall nor petitioner did anything toward disclosing the inventions to the public during this period. Hence, if there are any evil consequences, petitioner and Hall brought them upon themselves.

Furthermore, petitioner through its engineer Hall attempted to obtain the exclusive rights for this identical invention for their own use, even provoking the interference with one of the patents in suit causing expensive patent interference litigation finally terminating in the defeat of Hall's claim to priority of invention. Now Hall and petitioner assert that their activities should be regarded as having been "donated" to the public. In "equity and good conscience" one should not be permitted to first proceed to attempt to obtain the patent rights for their own exclusive benefit, and then only after being defeated claim that these same activities invalidate respondents' patents. The concurrent fact findings of the Courts below that the testimony introduced antedates the alleged prior use set up by petitioner should not "be disturbed unless plainly without "support" **General Talking Pictures Corp. v. Western Electric Co., et al.,** 304 U. S. 175. There is no doubt about the "support" in the instant case. The "support" was not only based on oral testimony as suggested by petitioner but by many clearly authenticated documents, such as PX-10, a drawing of December, 1918, notarized in Japan in September, 1919, as well as Ishimura's notebooks, PX-7 and 8, translations PX-7-A and 8-A.

It is important to note that **Ex Parte Grosselin,** 97 O. G. 2977, C. D. (1901) 248, cited on pages 21, 27, of petitioner's brief, refers to the cases relied upon by respondents such as **Hanifen v. Price,** 96 F. 435; **Hanifen v. Godshalk,** 78 F. 811; and **Welsbach Light Co. v. American Incandescent Lamp Co.,** 98 F. 613, and makes the same

distinction as that advanced by respondents here, to-wit: between Patent Office Interference and Patent Office Practice on the one hand and patent infringement suits against infringers in the Federal Courts on the other. In **Ex Parte Grosselin**, page 256, the Commissioner said:

> "In the present case there is no question of an infringer, but merely the question as to the rights of the public to the invention after it has been put fully into its knowledge by publication."

Here there was no publication whatever of Hall's alleged prior use.

Again, the two cases of **Vacuum Engineering Co. v. Dunn**, 209 F. 219, C. C. A. 2, and **Patents Selling & Exporting Co. v. Dunn**, 213 F. 40, C. C. A. 2, should be considered together. In the former, suit was brought on the Locke and Dunn patent, and the Schiodt patent was set up as a defense. Schiodt having made his invention in a foreign country, the Court held that under R. S. 4923 knowledge of the Schiodt invention abroad could not be used to defeat the Locke and Dunn patent. In the second of these cases suit was brought on the Schiodt patent, and having previously held in the first of these cases that Locke and Dunn were prior to Schiodt, the Locke and Dunn patent was treated as prior art to Schiodt. Thus these two cases again involved in effect a contest of priority between Locke and Dunn and Schiodt for the **same** patent rights. Here, Hall and petitioner are estopped from claiming Shimadzu's patent rights by reason of the amendment filed in the Patent Office by Hall accepting limited claims in the Hall patents. Hence the Dunn cases have no application here.

Respondents Position Is Not Based on a Mere Altruistic Theory that the United States Should Allow Persons All Over the World to Obtain Patents Here But, on the Contrary, By So Doing the American Public and Industry Has and Will Continue to Profit Thereby.

When R. S. 4886, or its predecessor, was amended to grant patents to citizens of any country of the world, of course it was not intended that patents so granted should have extraterritorial force as was attempted in **Brown v. Duchesne,** 19 How. 183, page 22 of petitioner's brief, where it was sought to enjoin infringement of a device on a foreign ship. But the United States patent statutes take full cognizance of many acts which occur in a foreign country. Thus, for over a hundred years, United States Patent Laws have contained a proviso making the validity of patents contingent upon whether or not the inveniton was described in any printed publication in any foreign country. Hence, descripiton in a printed publication in any foreign country has always been regarded as a statutory bar, although the act of publication occurred in a foreign country. **Downton v. Yeager Milling Company,** 108 U. S. 466, 471, 477. **Rosenwasser v. Spieth,** 129 U. S. 47, 50, 52.

One of the purposes of our patent statutes is to permit foreign citizens to obtain valid patents in the United States and enforce them here.

Moreover, practically all of the countries of the world grant patents to United States citizens. Hence, because the population of the United States greatly exceeds that of the majority of those foreign countries, the benefits received by the public of this country, with

respect to any particular foreign country, greatly favors this country. The remark in Congressional Record, p. 2275, supra, supporting the amendment to R. S. 4887 extending the time within which a U. S. application may be filed, that "probably no people will be favored so much" as the "people of the United States" is apt as showing why no substantial objection was offered to the enactment of this amendment.

The provisions of the United States statutes for granting Commissions and Letters Rogatory and taking depositions thereunder, indicate that in many cases it becomes necessary in connection with rights enforceable in the United States to obtain evidence in foreign countries.

The theory upon which the United States allows citizens of foreign countries to obtain patents here is not a benevolent one. On the contrary, definite benefits result to the public of the United States. Inventions which otherwise might not have become known here, and possibly might not have been made, are thereby disclosed to the American public and after the seventeen-year term become public property. The introduction of foreign inventions here greatly aids American industry and tends to increase employment. Hence, the policy of our statutes is clearly to further that end, and bring new foreign industries here if possible. As one example of how foreign inventors have benefited the public of this country, great savings have already been effected in the manufacture of storage batteries in this country through the use of the inventions here in issue. For example, this record shows that respondents' licensees

are paying royalties, which represent but 25% of the total savings, at the rate of at least $40,000.00 a year. This means that the savings in dollars and cents to the licensees (and in turn to the public of this country) have amounted to at least $160,000.00 a year. Thus, over a fifteen-year period the savings resulting from the use of the inventions by one licensee would amount to at least $2,400,000.00.

This is only one instance in the history of our patent system.[6] There are many instances of where valuable inventions created in foreign countries which have been patented in the United States have proved of great value to industries in this country.

On the value of patents, this Court stated the principles of patent law as late as 1932 in **U. S. v. Dubilier Condenser Corp.**, 289 U. S. 178, 186, as follows:

> "By Article 1, §8, clause 8 of the Constitution, Congress is given power to promote the progress of science and the useful arts by securing for limited times to inventors the exclusive rights to their respective discoveries. R. S. 4886 as amended (U. S. Code, Title 35 §31) is the last of a series of statutes which since 1793 have implemented the constitutional provision.
>
> Though often so characterized, a patent is not, accurately speaking, a monopoly, for it is not created by the executive authority at the expense and to the prejudice of all the community except the grantee of the patent. Seymour v. Osborne, 11 Wall.

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[6] Actual count indicates that in the year 1937 over 4,900 patents were issued to citizens or residents of most important foreign countries by the United States.

516, 533. The term monopoly connotes the giving of an exclusive privilege for buying, selling, working or using a thing which the public freely enjoyed prior to the grant. Thus a monopoly takes something from the people. An inventor deprives the public of nothing which it enjoyed before his discovery, but gives something of value to the community by adding to the sum of human knowledge. United States v. Bell Telephone Co., 167 U. S. 224, 239; Paper Bag Patent Case, 210 U. S. 405, 424; Brooks v. Jenkins, 3 McLean 432, 437; Parker v. Haworth, 4 McLean 370, 372; Allen v. Hunter, 6 McLean 303, 305-306; Attorney General v. Rumford Chemical Works, 2 Bann. & Ard. 298, 302. **He may keep his invention secret and reap its fruits indefinitely. In consideration of its disclosure and the consequent benefit to the community, the patent is granted.** An exclusive enjoyment is guaranteed him for seventeen years, but upon the expiration of that period, the knowledge of the invention enures to the people, who are thus enabled without restriction to practice it and profit by its use. Kendall v. Winsor, 21 How. 322, 327; United States v. Bell Telephone Co., supra, p. 239."

It is Well Settled That a Domestic Inventor May Introduce Fact Testimony to Establish His Dates of Invention.

Since the Amendment of 1836, all Courts have consistently permitted the date of the invention of a patent-in-suit to be carried back of the date of such alleged defense. Thus, this Court stated in **Bates v. Coe,** 98 U. S. 31, 34:

> "... the presumption in respect to the invention described in the patent in suit, if it is accompanied by the application for the same, is that it was made at the time the application was filed, and the complainant or plaintiff may, if he can, introduce proof to show that it was made at a much earlier date."

This Court also held in **St. Paul Plow Works v. Starling,** 140 U. S. 184, 198, that it was proper for plaintiff to introduce antedating testimony that "he had reduced the invention covered by his first claim to practice, in a working form" to antedate a defense, citing **Elizabeth v. Pavement,** 97 U. S. 126, 130 and **Loom Company v. Higgins,** 105 U S. 580, 592, in which latter case this Court held Webster's patent valid over a defense of a prior use because of the antedating testimony presented by the patentee. In the recent case of **Barber v. Otis Motor Sales Co.,** 265 Fed. 675, 679, the Court stated:

> "... it is well settled that, as against the statutory defense of anticipation, the patentee may show, if he can, the fact of his prior invention by drawings, sketches, models, or by any other competent proofs."

citing many of the above cases.

Conclusion Point I

Respondents are unable to summarize their views in respect of this point any more aptly than by quoting the following excerpt from an opinion by Judge Dallas in **Hanifen v. E. H. Godshalk, et al.,** 78 Fed. 811, wherein the Court stated:

"There is no statute which warrants the suggested distinction respecting inventions made abroad and those made in the United States. Section 4886 of the Revised Statutes enacts that 'any person who has invented or discovered any new and useful art, * * * not known * * * before his invention or discovery thereof, * * * may * * * obtain a patent therefor.' The right to a patent is thus made to depend, as to the point under discussion, wholly upon time of invention as related to then-existing knowledge, etc., and nothing whatever is said with respect to the place of invention. The learned counsel of the defendants have argued that it would be incongruous to permit a public use and sale abroad, more than two years before application, to save a patent by establishing date of invention, when such use and sale, if it had occurred in this country, would have operated to defeat the patent. A sufficient answer to this argument would be that the supposed incongruity is one which the law-making power has seen fit to create, but a more satisfactory one is that no dilemma whatever is really presented. There is no inconsistency between the substantive law which provides that a foreign public use shall not, in itself, invalidate a patent, though a similar use and sale here would do so, and the law of evidence under which such foreign use and sale may be shown to fix date of invention. The same evidence which for one purpose would be inadmissible may for another be competent. An offer to prove public use and sale in a foreign country more than two years before the filing of the application would, if made to invalidate a patent, be manifestly irrelevant, for the reason that it could not have that effect but a like offer, if made to show date of inven-

tion, would, quite as manifestly, be relevant, because it might, at least, tend to establish it. If there is anything in this state of the law which is extraordinary, I fail to perceive it. Several decisions of the Patent Office, extending from 1872 to 1888, have been examined. They show a consistent view of the law to have been there adopted and established, from which I certainly would not dissent without much hesitation and very full consideration. But those decisions do not relate to the precise question which is now before the court, and will not be affected by the conclusion which I have reached respecting it. They were all enunciated in interference proceedings * * *

In other words, what has been held is that the single fact of previous invention in the United States is but that mere previous invention in a foreign country—i. e. without patent or printed publication—is not a bar to the grant of a patent; but it has not been held that, where an uncontested application is founded upon invention abroad, the grant of a patent is invalid if a sufficiently remoted date of invention cannot be established without acceptance of the time when the invention had been made in a foreign country; and it seems to me that, while the actual rulings of the Patent Office conform to the law, they could not, without conflicting with it, be made applicable to the present subject. They are supported by the terms of Section 4923, but the inference now sought to be deduced from them is quite as plainly inhibited by Section 4886. Thomas v. Reese, 17 O. G. 195; Hovey v. Hupland, 2 O. G. 493; Chambers v. Duncan, 10 O. G. 787; Lauder v. Crowell, 16 O. G. 405; Rumpff v. Kohler, 23 O. G. 1832; Boulton v. Illingworth, 43 O. G. 508.

"I know of no case in which this point can be said to have been judicially determined. I believe it was not argued, and am sure it was not investigated by the Court, in Uhlman v. Brewing Co., 53 Fed. 485. That case seems to have been presented as one of conflict between two patents, and in such manner as to direct attention only to the inquiry whether the Stockheim or the Klein invention 'was first known or used in this country.' It appears to have been assumed that the inquiry stated was in that case the material one, and the particular question which is now for solution was, apparently, not then discussed, and certainly was not considered. Reference has been made to several opinions delivered by Judge Coxe, but which, when read together and in connection with the observations made upon them by the Court of Appeals for the Second Circuit, do not, I think, indicate that the view of the law which I have expressed is at variance with that which is entertained in that jurisdiction.

In **Electrical Accumulator Co. v. Julien Electric Co.**, 38 Fed. 117-128, Judge Coxe said:

> 'The evidence of prior invention by Charles F. Brush is now to be considered. In determining this question, Faure, being at that time a citizen of France, is not permitted to claim the invention earlier than the date of his French patent, which was October 20, 1880,' etc.

"The learned judge did not state the ground on which he rested this proposition, and cited no authority for its support. The gist of it seems to be that Faure's French citizenship (not the place of invention) precluded him from claiming his invention as of a date earlier than that of his French

patent; but, in the absence of explanation, I infer that it was Section 4923, and not Section 4886, which was in contemplation, and that what was really meant is that, under Section 4923, the patent of Brush should not be held to be void on account of prior invention in a foreign country, 'if it had not been patented.'

"Thus it appears that the Circuit Court and Court of Appeals both regarded as an important circumstance the fact that Brush was an original inventor and a patentee; and there is no difficulty in reconciling the ruling that, as against such a party, prior invention abroad, without patent or publication, is of no consequence (Section 4923), with the position that as against one who is neither an inventor nor a patentee, but an infringer, the owner of a patent may show that the invention was made, though in a foreign country, at a time when it was not known or used in this country, nor patented or described in any printed publication in this or any foreign country (Section 4886).

"I have reached the conclusion that it was competent for the complainant to prove the actual date with reference to invention made in England; . . ."

See also—

Hanifen v. Price, 96 F. 435
Welsbach Light Co. v. American Incandescent Lamp Co., 98 F. 613
Badische Anilin & Soda Fabrik v. A. Klipstein & Co., 125 F. 543
Claude Neon Lights, Inc., v. Rainbow Light, Inc., 47 F. (2d) 345.

From a consideration of the foregoing history of the patent statutes and of the authorities cited, it is mani-

fest that petitioner's contention with respect to the issue presented under Point I is untenable. This issue is controlled by R. S. 4886. The language of that Section is clear and unambiguous. Under the present wording of the statute, in the absence of any limitation upon the place of discovery or invention, respondents are clearly entitled to rely on the real date of Shimadzu's invention irrespective of the fact that his inventive acts occurred in a foreign country.

POINT II

(1) Suppression and Concealment of Invention Were Neither Pleaded by the Petitioner in the Answer nor Urged Before Either the District Court or the Circuit Court of Appeals; Therefore Such Alleged Defenses Not Properly Before This Court.

No such defense is found in the Answer, nor elsewhere in the record, nor was it advanced during the trial nor on the arguments nor in the briefs before the District Court. It was not argued in the Circuit Court of Appeals nor mentioned in petitioner's briefs before that Court. It cannot properly be raised *de novo* in this Court. No testimony was taken by petitioner directed toward such a defense. After Shimadzu and his witnesses had been examined in Japan and voluminous testimony taken on the trial without any such defense having been raised, it is clearly inequitable for respondents to

have to meet such a question for the first time in this Court, especially where this belated plea by a petitioner relates to facts particularly within the knowledge of respondents. Had respondents been properly put on notice, adequate rebuttal testimony could have been introduced. It is too late for petitioner to raise it now. Such procedure was condemned by this Court in **Rubber Company v. Goodyear**, 76 U. S. 788, 801, where this Court stated referring to a belated plea in a patent case:

> "The answer of the defendants is as silent upon the subject as the bill of the complainants. No such issue was made by the pleadings. It was too late for the defendants to raise the point before the master. They were concluded by their previous silence, and must be held to have waived it. It cannot be considered here."

(2) In any Event the Record Fails to Show any Suppression or Concealment by Shimadzu of His Inventions During Which any Intervening Rights Accrued So as to Warrant Invalidating His Patents.

Had this defense been pleaded, the burden would have been upon petitioner to establish it. This, petitioner has not done. In fact, the evidence directed to other phases of the case shows conclusively that there was no such suppression or concealment.

After his reduction to practice in August, 1919, Shimadzu proceeded immediately to install new mills, a new plant, and was continually improving the commercial and economical efficiency of his process, and the effect of the various elements of his operations. (R. II, 1140) (PX-7A and 8A). Shimadzu states (R. II, 1138):

"Finally, in June, 1920, my superhuman effort was rewarded materially. The batteries made from my product were high in dependability and long in life."

Respondent's first United States application (PX-39) was filed in December, 1920, and refers to pulverizing metallic lead into a fine powder by "mechanical means". Obviously, in view of all the testimony of record the "mechanical means" referred to is the rotating drum used by Shimadzu in 1919 and in the new plant set up by June, 1920 (R. II, 1140). In an extensive amendment filed in the United States Patent Office July 18, 1922 (PX-39) Shimadzu disclosed various features of the '150 patent.

In view of this fact, the United States Patent Office permitted Shimadzu to state in the application for '150 patent that it was a continuation of the earlier 1920 application (PX-39). This Court stated in **General Talking Pictures Corporation v. Western Electric Company, Inc., et al.**, 304 U. S. 175, 183:

> **"The effective dates of the claims of the continuation applications are those of the original applications."**

On this basis, as to common subject matter, the effective filing date of the '150 patent is December, 1920.

Application No. 431,473 filed December 17, 1920, was co-pending and over-lapping with application for patent No. 1,584,149, filed January 30, 1922, which in turn was pending at the time of the filing of application for patent No. 1,584,479, filed February 20, 1923, and patent No. 1,584,150 filed July 14, 1923. The

inventor was a Japanese, living more than 6,000 miles away. The subject matter of his invention had to be translated, mailed to this country to a patent solicitor, adapted to our patent practice, with time required for correspondence between the solicitor and his client, and then filed in the Patent Office. Diligence, rather than lack of diligence, is conclusively shown. Certainly such activity by a foreign inventor cannot be described as any deliberate suppression or abandonment of the inventions.

As to Shimadzu's activities, the record shows that Shimadzu stated (R. II, 1140):

> "From June, 1920, on I was performing experiments in the newly built lead powder factory, producing at the same time for commercial purposes.
>
> * * * * *
>
> "In 1922 I began exact qualitative analysis of the product."

On Page 1144 of the record Shimadzu states:

> "After I started the experiments on the making of the lead powder I partly completed the process in the spring of 1919, and in 1920, when I almost completed the industrial process."

On Page 1148 of the record Shimadzu testifies as follows:

> "Now, any invention takes a great deal of time and energy. In order to complete the invention, first an idea is formed in the inventor's mind; it undergoes stages of mental development. Then it materializes, then it is made into a model in crude form, and requires many improvements and years of hard work."

There is no evidence that Shimadzu was spurred into activity by reason of any intervening rights of third parties. He was a pioneer in solving the problem in this long-sought art, which the industry throughout the world had been trying to solve.

There is absolutely no claim that any knowledge of petitioner's activities was communicated to Shimadzu directly or indirectly (R. II, 1163, 1177, 1179). If anything, the record suggests that petitioner, through its engineer, Hall, was spurred into activity by knowledge of Shimadzu's inventions disclosed in chemical publications to which it subscribed in the early part of 1924 (R. II, 1038, 1039). If public use of the inventions by petitioner and Hall commenced in June, 1921, why was Hall's application for a patent not filed until March 29, 1924, and why did Hall, at that time, swear that the inventions were not in "public use" if his experiments were not strictly "private"? During this period Shimadzu filed his applications for United States patents. If any estoppel is to be applied it should be against the petitioner. In fact, the record affirmatively shows that the public of the United States actually derived the benefit of the inventions from Shimadzu.

The concurrent decisions of the courts below resolve this issue in respondents' favor and it is therefore not properly a question for review here on certiorari. **General Talking Pictures Corp. v. Western Electric Co.,** 304 U. S. 175, 178, 179.

The case of **Kendall v. Winsor,** 21 How., 322, 328, cited by petitioner is in accord with the decisions below. In that case this Court stated:

> "But the relation borne to the public by inventors, and the obligations they are bound to fulfill in order to secure from the former protection, and the right to remuneration, by no means forbid a delay requisite for completing an invention, or for a test of its value or success by a series of sufficient and practical experiments; nor do they forbid a discreet and reasonable forbearance to proclaim the theory or operation of a discovery during its progress to completion, and preceding an application for protection in that discovery. The former may be highly advantageous, as tending to perfecting the invention; the latter may be indispensable, in order to prevent a piracy of the rights of the true inventor."

The evidence showed that there the inventor constructed a machine in 1846 and several in 1849, which were used in trade until the patent therefor was applied for in 1854, an interval of at least five years. Moreover, in that case the inventor deliberately announced that he proposed to maintain the invention a secret and tried to do so, this Court stating in that case, p. 324, that the inventor

> "repeatedly declared to different persons that the machine was so complicated that he preferred not to take a patent, but to rely on the difficulty of imitating the machine, and the secrecy in which he kept it."

It is indicated in the opinion that the inventor would never have filed an application had he not learned that a competitor had duplicated his machine. For nine years, the patentee in that case had attempted to maintain the inventions secret. This Court approved the charge of the lower Court to the jury, in effect, that to

constitute such abandonment to the public by concealment as will destroy the inventor's right to a patent, where no sale or public exhibition has been made, "the jury must find that he intended to give up and relinquish his right to take letters patent". Finally this Court held that the question was one of fact and peculiarly within the province of the jury, and approved the charge to the jury (p. 331) which found that the inventor was entitled to his patent.

The quotations from the other cases referred to by petitioner are not helpful unless the facts are shown. Thus:

In **Wirebounds Patents Co. v. Saranac Automatic Mach. Corp.**, 65 Fed. (2d) 904, suit was brought on a method patent which was issued on a divisional work-holder patent application which had been filed October 14, 1904. No method claims were filed at that time nor until 1912 in a divisional application. The interferences in the Patent Office were only on machine patents and had nothing to do with a method or process, and it was held that they were no excuse for delay in presenting claims to the method or process.

In **Victor Talking Machine Co, v. Starr Piano Company**, 281 Fed. 60, the original application was filed by Johnson August 16, 1898. The patent actually in suit came from a divisional application in the Patent Office which was not filed until 1904. In the meantime one Jones had taken out a patent based on application filed in November, 1897. Johnson, thinking the particular part of his invention invalid, for years kept his process secret, and the Court held there was an abandonment under the decisions.

In **U. S. Rifle and Cartridge Co. v. Whitney Arms Co.**, 118 U. S. 22, an inventor's application for patent was rejected and withdrawn by him. Without substantial reason or excuse he omitted for eight years to reinstate or renew it, during which time many patents embodying the substance of the invention were granted to others. Naturally the court held there was an abandonment.

In **Webster Co. v. Splitdorf Co.**, 264 U. S. 463, the original application was filed February 2, 1910. On June 17, 1918, although the application had been pending since 1910, the claims in suit were presented after more than eight years' delay. "During all this time their subject matter was disclosed and **in general use**," this Court so stating in that case, page 465. After such general use, the patentee brought forward **broader** claims than those originally sought, attempting to thus **expand** his original invention. No such facts are present here.

In **Woodbridge v. U. S.**, 263 U. S. 50, the inventor, after allowance of patent, procured the papers to be filed in the secret archives, and for nearly ten years deliberately abstained from requesting issuance of patent in order to postpone the beginning of the patent monopoly. This was a clear case of abandonment by conduct.

Clearly, Shimadzu did not suppress, conceal or withhold his inventions to the detriment of any person in the United States so as to now be estopped to enjoy fully the rights granted him.

POINT III

The Concurrent Holdings by the Courts Below of Validity of the Patents in Suit Should Not be Disturbed Irrespective of Petitioner's Alleged "Public Use".

(1) Admittedly there can be no such defense against Patent No. 1,584,149.

Patent No. 1,584,149 was applied for on January 30, 1922. The earliest date on which commercial (not public) production may have been begun by petitioner is June, 1921, a little more than six months before No. 1,584,149 was applied for. Petitioner's process was found to infringe this patent and a decree for an injunction and accounting made. Clearly, therefore, petitioner's alleged public use cannot affect this patent because such use is not claimed to have commenced more than two years prior to the filing of the application therefor.

(2) The Defense of Alleged Public Use was not Properly Pleaded and Therefore that Question is not Open In This Court.

Notwithstanding petitioner's discussion of the pleading in its brief, pgs. 34-36, it is pointed out that no "public" use by defendant is affirmatively alleged in the Answer as required by RS 4920.

In fact, petitioner was careful not to allege in its answer (R. I. 35) that the inventions had been in **public use** for more than two years prior to respondents' patent applications. Petitioner relies, however, on respondents' allegations and its alleged denials. An examination, however, of the pertinent paragraphs of the

pleadings reveals that petitioner in answering allegations of paragraphs 5, 7 and 15 of the Bill of Complaint (R. I, 8, 9, 14) denied knowledge of its alleged public use. For example it alleged in paragraph 5 of its Answer (R. I, 38) as follows:

> "5. Answering Section 5 and 6 of the bill, defendant admits that one of the patents in suit, No. 1,584,150 was granted on the 11th day of May, 1926, but is **not informed** except by the bill of complaint as to the truth of the other allegations (among them the allegation of lack of two years prior public use) the made and therefore denies the same and denies that said patent was duly or properly issued or granted."

It is thus clear that what petitioner here alleged was that it was not informed as to the allegation in the bill that there was no two-year prior public use. It cannot now claim that its own use constituted a two-year prior public use, in view of the allegation that it was not informed as to such use. Certainly, if its own use is the public use relied upon, it could not say that it was **not informed** as to it.

Under the provisions of R. S. 4920, the defense of public use is a special defense which must be specifically pleaded by a defendant. Failure to comply with such statutory prerequisite therefore prevents the petitioner from urging this belated defense. **Angle v. Richardson,** 19 Fed. Supp., 1002, 1004; **Abrahams v. Universal Wire Co., Inc.,** 10 Fed (2d) 838, 842; **The Byrne Manufacturing Company v. American Flange & Manufacturing Co., Inc.,** 58 Sup. Ct. 18. The reason for this rule is sound. Respondents, in view of the pleadings, had no occa-

sion on the trial to examine petitioner's witnesses or to offer independent testimony on an issue not in the record, which they otherwise might have done had they been properly apprised of such a defense. Likewise, this question was not urged on the trial, nor was it urged in the numerous briefs filed by petitioner, until after the District Court's decision, referring to the "commercial production by the Hardinge Mill." Petitioner unsuccessfully raised this defense for the first time in the Circuit Court of Appeals. Therefore, to entertain this belated plea now would work a gross injustice upon respondents, **Rubber Co. v. Goodyear, supra.**

Petitioner claims in its brief (p. 35) that respondents did not object to petitioner's answer on the ground of inadequacy or object to any testimony that its alleged use of its process was a public use. But how could respondents object on the ground that the answer did not plead two years public use if the petitioner elected not to so plead, and how could it object to any testimony that such use was "public" when there was no such testimony? The reasons why petitioner neither pleaded nor proved that the inventions in question were "in public use for more than two years prior" to the applications are obviously because such pleading and proofs would have invalidated Hall's own patents No. 1,675,345 and 1,888,823 under which petitioner was operating (R. I, 59), and that Hall activities were not considered by petitioner as public use.

(3) Both Lower Courts Having in Effect Found that the Inventions of the '150 and '020 Patents Were not in Public Use Within the Meaning of RS 4886 by Holding Said Patents Valid Have Resolved a Question of Fact in Respondents' Favor Which has Unquestionable Support by the Record and Should not Be Disturbed Here.

It is too obvious for extended argument that both Courts resolved this question of fact in respondents' favor. There is no finding of such public use. The concurrent holdings reached by both Courts below were that the patents in suit are valid. Hence the familiar rule applies, and it is respectfully submitted that this question of two-year public use having been decided concurrently below in favor of respondents should not be disturbed here, unless clearly without support (which is not the fact here). **See General Talking Pictures Corp. v. Western Electric Co., et al.,** 304 U. S. 175,[7] where this Court indicated that a decision against a "public use" was a fact finding, stating, 182, 183:

> "The District Court and Circuit Court of Appeals found that there was no public use of either of the inventions of the first two patents prior to the filing dates of the divisional applications upon which they issued. These findings were made upon adequate evidence . . ."

Moreover, this Court in the same case, page 178, stated:

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[7] See also such cases as: Thomson Spot Welder Co. v. Ford Motor Co., 265 U. S. 445; St. Paul Plow Works v. Starling, 140 U. S. 184, 196; Coupe v. Royer, 156 U. S. 565, 577; Bischoff v. Wethered, 9 Wall. 814.

"Whether respondents acquiesced in this infringement and are estopped depends upon the facts. Granting of the writ would not be warranted merely to review the evidence or inferences drawn from it. Southern Power Co. v. N. C. Public Service Co., 263 U. S. 508. United States v. Johnston, 268 U. S. 220, 227. Moreover, the decision on that point rests on concurrent findings. They are not to be disturbed unless plainly without support. United States v. Chemical Foundation, 273 U. S. 1, 14. United States v. McGowan, 290 U. S. 592. Alabama Power Co. v. Ickes, 302 U. S. 464. There is evidence to support them."

(4) There is Ample Evidence to Support the Concurrent Findings Below, in Fact the Record Clearly Establishes that the Inventions in Suit Were not in Public Use for More Than Two Years Prior to the Actual Filing of the Application for the '150 Patent nor for the '020 Patent Which is Entitled to the Same Filing Date.

This defense must be proven by clear convincing evidence "beyond a reasonable doubt", **Eibel Process Co. v. Minneapolis & Ontario Paper Co.**, 261 U. S. 45. Respondents respectfully submit that not only is the defense not proven, but the concurrent findings below against such defense are clearly supported by the record. The Courts below indicated that an essential feature of the Shimadzu inventions is the production of a suitable battery compound on a commercial scale. Thus, the Court stated (R. II, 1164) that—

"... some process by which the right kind of powder could be produced in trifling amounts was of very little value to anyone. The industry was looking

> for a way to make large quantities cheaply, and an invention which fell short of accomplishing that result would have been of academic interest only."

Again, the Court in showing how the Tudor Mill was unsuccessful, pointed out (R. II, 176) that it did not "meet the requirements of a commercially useful process." Hence, the Court's use of the word "commercial" was merely to distinguish between an operation conducted on a commercial scale in order to determine its economic value from one conducted on a laboratory scale. No thought that the operation was of a "public" nature is even remotely intimated. Petitioner's experiments during this period were with a "second-hand" 5-foot Hardinge Mill (R. I, 468) in contradistinction to the 6-foot standard production mills set up in petitioner's new plant at Crescentville in 1923, with respect to which the witness Smith stated "that in July, 1923, production of Gray Oxide began" (R. I, 466).

The word "public" is defined in Webster's New International Dictionary, Second Edition, Unabridged, as follows:

> ". . . of or pertaining to the people, relating to, belonging to, or affecting, a nation, state, or community at large—opposed to private; . . ."

Thus, "public" is used in antithesis to "private." A "commercial" use might be either "public" or "private" depending on the facts. In the instant case it was certainly private. The record fails to show that a single member of the public had access to this experimental work conducted by defendant's employees. In fact, petitioner's witness stated (R. I, 499) that—

"On rare occasions, we do let people in to see these mills in the plant now."

In other words, at the date of giving the testimony (1935), long after Hall's patent had been issued, petitioner permitted outsiders "on rare occasions" to see the mills, but there is no evidence of any such admission of outsiders even "on rare occasions" during the critical period.

The record implies that in 1921 the powder produced by this mill was not actually used in production, although produced by the experiments on a commercial scale. Thus, when called upon to state what percentage of petitioner's requirements was produced by the Hardinge Mill, no figures whatever were given for any part of the year 1921, notwithstanding that the "critical date" is July 14, 1921, for the two-year period. This failure must be resolved against petitioner. Public use requires that the use be primarily in the ordinary channels of trade. As petitioner has shown no production for the year 1921, it has thereby conclusively rebutted its allegation of public use during that period.

Again, the record does not show any sale of any product to the public. When this lead dust was produced by the Hardinge Mill, petitioner's department of development and design issued a special process, No. 5065, for battery tests purposes (R. I, 465) the last sheet being dated October 26, 1922. The witness Smith introduced DX-68 as an illustration thereof and at the top printed in large letters are the words "Experimental Shop Process." Hence, according to petitioner's own witnesses and documentary evidence, the activities up until October, 1922, were regarded as experimental.

Moreover, petitioner's policy of secrecy is also shown by the necessity of a court order for inspection of its process. Petitioner objected to any of respondents' engineers entering the plant. The appointment of a special expert by the Court was necessary before respondents could ascertain anything about petitioner's present-day practice.

Moreover, in the interferences Mr. Hall in October, 1928, testified (PX-41, p. 55):

> "X-Q. 127. Would you mind showing us one of those mills that the Electric Storage Battery is now using?
>
> "Mr. Stoughton: That is a question that you may or may not, as you please, refuse to answer unless and until ordered by the Court to do so.
>
> "A. I am not going to show these mills."

(5) There Is No Proof of Public Use of the Process as Distinguished From the Product.

The claims here involved are for a process and a machine, not for a product. The finding that the petitioner used the product when the public did not see the process will avail the petitioner naught. The record is barren of any evidence that the public ever saw or knew the process during the critical period.

As an indicia of "public use", petitioner claims that certain employees familiar with its process left its employ under no pledge of secrecy in 1916 and 1918, long prior to the installation of the Hardinge Mill (R. I, 539). Respondents' witness Cooper did not enter the employ of the petitioner until June, 1923 (R. I, 401). Thus, Cooper stated (R. I, 401):

> "I went to work for them (petitioner) in June, 1923, and left there some time in the year 1930."

There is no evidence when Nagle entered or left its employ. The knowledge of such employees therefore could have no bearing on the question of "public use" subsequent to June, 1921, and prior to July, 1923. The record fails to show that even such employees left without pledge of secrecy. In any event, even if petitioner's employees were under no pledge of secrecy, that fact alone would not establish public use.

Each case involving a "public use" issue must stand on its own peculiar set of facts. In interpreting this statutory bar, it is well settled law that use even in public, whether on a commercial or laboratory scale, if primarily for test purposes in order to ascertain the "utility, value or success of the thing invented by patentee," will not defeat the patent. The basic case for this doctrine is **Elizabeth v. Pavement,** 97 U. S. 126, 134, 135, where this Court stated:

> "The use of an invention by the inventor himself, or of any other person under his direction, by way of experiment, and in order to bring the invention to perfection, has never been regarded as such a use.
>
> * * * * *
>
> "When the subject of invention is a machine, it may be tested and tried in a building, either with or without closed doors. In either case, such use is not a public use, within the meaning of the statute so long as the inventor is engaged, in good faith, in testing its operation. He may see cause to alter it and improve it, or not.
>
> * * * * *

"Whilst the supposed machine is in such experimental use the public may be incidentally deriving a benefit from it. If it be a grist-mill, or a carding-machine, customers from the surrounding country may enjoy the use of it by having their grain made into flour, or their wool into rolls, and still it will not be in public use, within the meaning of the law."

Moreover, if the use of the patented article is for experimental purposes, the period within which the application must be filed does not run until the experimentation ceases **Cline Electric Mfg. Co. et al. v. Kohler,** 27 Fed. (2d) 638, certiorari denied, 49 S. Ct. 82.

The alleged prior public use relied upon by petitioner, is the identical work of Hall, petitioner's engineer, which formed the basis of Hall's application filed in March of 1924, and as we shall point out, Hall was engaged "in good faith in testing its operation."

When an application for patent is filed, the inventor under RS 4888 **must** not only explain the principle thereof, but give "the best mode in which he has contemplated applying that principle." Hence, it is obvious that before Hall, petitioner's engineer, could properly do so, it was necessary for him to make the tests of the nature referred to by this Court in **Elizabeth v. Pavement,** supra. Bearing in mind that petitioner has in effect admitted (R. II, 1032) that it obtained no production from the second-hand Hardinge Mill (R. I, 468) for the year 1921, and that in the lower Courts' view, the inventions here required tests on a commercial scale as being of "the essence of the invention" as stated above the facts of the record clearly bring the instant case within the doctrine of the Elizabeth case. It is

therefore clear that the lower Court, in not finding "public use" against any of the patents in suit, reached conclusions both concurrent and correct, and supported by the record.

Briefly reviewing the record on this score, we again find that support in the evidence. Petitioner's uses were clearly experimental from June, 1921, on until the end of that year and in fact until 1923 when standardized machines were bought (R. I. 466).

Petitioner's own witnesses establish that there were several factors "vital" to the success and the commercial operation of the alleged invention. Thus, Smith states that matter of load was "vital" (PX-41, p. 453). The load (or amount of charge in the drum) used by petitioner in the experimental use at first was under 14,000 pounds (R. I, 515). However, in September, 1921, two months too late to have any effect on the patents in suit, this load was increased to 19,000 pounds (DX-61, sheet 1 of 9-26-21 test). This is the amount referred to in Hall's patent application filed in 1924 and is the amount now used. Such substantial variation in the amount of lead charged into the mill indicates the primarily experimental nature of the operation. Although talking about a duplicate of the Hardinge Mill, petitioner's witness Smith also stated:

> "It has been found that that matter of charging the mill is also a very vital point in its operation. It must be charged correctly, and by charging too much I suspect they interfered with the operation so as to make it, as we have said, commercially unsuccessful."

However, petitioner did not revert to the load of 15,000 pounds of June, 1921, but continued to improve the other factors so as to be able to use the 19,000-pound load of September, 1921.

Again, the "percentage of oxidation" was also described as vital. Petitioner's witnesses state that the "low oxidation" material had no commercial utility whatever and had to be abandoned. Thus, Hall, stated (R. II, 1025) "I never said I used that low oxidation stuff commercially" also specifying "The low oxidation is made for experiments." As to the use of the "low oxidation" powder, Hall also stated (R. II, 1027):

> "I made plates out of it, but they just weren't worth a whoop, and we had to throw them all out."

These experiments were subsequent to the critical date. In June, 1921, the percent oxidation was between 57% and 68% (DX-60). Yet in August, petitioner's engineer increased the percentage oxidation to 86% (DX-62). In September, 1921, however, the oxidation was reduced to 44 to 51%, the very lowest percentage of any of petitioner's tests (DX-61). Presumably, this was the "low oxidation powder" which Hall stated he did not use. (R. II, 1027). In October it attained a high of 71% (DX-64), while in December it was reduced to an average of 67% (DX-63), the average finally adopted.

Considering a third vital factor, at no time during this 1921 period did the amount of air exceed 33 cubic feet per minute, the maximum capacity of the fan then employed (DX-43). The air was reduced from a value registered as 1.70 in September (DX-61) down to .25 in

December (DX-63) although it later turned out that a vastly larger blast of air than used in any of these tests was required.

Considering now these same factors as set forth in Hall's application filed in June, 1924, we find further important changes as compared with the early experiments in 1921. The amount of air was increased from a maximum of 33 cubic feet per minute in 1921 to 150 cubic feet per minute, an increase of about 500% in 1924. The load instead of being the 15,000 pounds used in the experiment of June, 1921, was 19,000 pounds in 1924. The temperature was specified as high as 375 in 1924 compared with 275° of the 1921 "commercial" experiments—an increase of 32%. Petitioner's present practice is still further removed from the 1921 experiments.

From the foregoing it is evident that the lower Courts were correct in not finding that the invention in question had been in "public use" in this country for more than two years prior to the patentee's applications.

(6) Hall's Oaths in His Patent Applications and Preliminary Statements Executed Prior to this Litigation Estop Defendant From Claiming "Public Use" Based On Identical Activities Referred to in Said Oaths.

In Hall's application (PX-18), Hall swore that the very apparatus and process now alleged to consfitnte the "public use" had not been in public use or on sale more than two years prior to the filing of his application in March, 1924. As the "critical date" for this alleged two-year public use defense against the '150 and '020 patents is July, 1921—two years prior to the

United States filing date for the '150 patent—this alleged defense of public use completely fails. Hall likewise made similar oaths in his preliminary statements in the Hall-Shimadzu Interference, (PX-41, pp. 13, 14, 18). These three oaths were made long prior to the present controversy and so have much greater weight than the oral testimony of witnesses at the trial. In fact, no witnesses at the trial testified that the inventions here in issue were in "public use." Hall, who should know the facts the best of any of the witnesses, although examined as a witness by petitioner on the trial, was not called upon to testify with respect to any such "public use." Under familiar rules of evidence, it must be assumed that if he had testified on this point, his testimony would have been unfavorable to petitioner. Respondents submit that these three oaths by Hall that the inventions in question were not in "public use" conclusively rebut petitioner's present contention that Hall's early activities constituted a public use of the inventions in suit and that petitioner—being in privity with Hall—is estopped from asserting the same. Petitioner stipulated (R. II, 780):

> "... that defendant paid the expenses of the Interference proceedings between Hall and Shimadzu, the record of which is marked Plaintiffs' Exhibit 41."

Moreover, under Rule 126[8] of the Rules of the United States Patent Office, during the pendency of

[8] For the convenience of the Court, Rule 126 of the Rules of Practice in the United States Patent Office is set out in full in the Appendix.

the interference, if the Examiner of Interferences or the Board discovers any grounds in the testimony which "amounts to a statutory bar to the grant of a patent to either of the parties for the claim or claims in interference" it is his duty to call the attention of the Commissioner of Patents to the same, whereupon the Commissioner may suspend the interference and reject the claims. It frequently arises that the testimony taken in an interference shows a public use. In the instant case, no such recommendation was made by any of the tribunals of the Patent Office passing on the record. This raises the clear presumption that those tribunals did not regard these experimental tests as amounting to a "public use" within the meaning of the statutes, or to "constitute any statutory bar" as referred to in Rule 126.

CONCLUSION

From the foregoing, the concurrent findings of the Courts below holding patents 1,584,149, 1,584,150 and 1,896,020 valid and infringed are correct and should be sustained. Respondents clearly had the right to introduce the foreign testimony to antedate petitioner's alleged prior use. Patent 1,584,149 by reason of the filing date of the application therefor in the United States is not in any way affected by petitioner's Points II and III. The concurrent holdings of the Courts below, in effect resolving in favor of respondents any alleged defenses of public use, and concealment and suppression affecting patents 1,584,150 and 1,896,020 are clearly correct and should be sustained.

The decree of the Court below should be affirmed or, in the alternative, the Writ of Certiorari should be dismissed.

Respectfully submitted,

EDMUND B. WHITCOMB,

GEO. WHITEFIELD BETTS, JR.

Counsel for Respondents.

Dated: January 27, 1939

APPENDIX

		Page
R. S. 4886	Section 31. Inventions Patentable	1-a
R. S. 4887	Section 32. Inventions Previously Patented Abroad	1-a
R. S. 4892	Section 35. Oath of Applicant	2-a
R. S. 4920	Section 69. Pleading and Proof In Actions for Infringement	3-a
R. S. 4923	Section 72. Patent Not Void for Previous Use of Thing in Foreign Country	4-a
Rules of Practice in the United States Patent Office Rule 126		5-a
Statutory History of R. S. 4886		6-a
Statutory History of R. S. 4887		9-a
Statutory History of R. S. 4923		12-a

R. S. 4886
Section 31. Inventions Patentable.

Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, or who has invented or discovered and asexually reproduced any distinct and new variety of plant, other than a tuber-propagated plant, not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor. (R. S. 4886; May 23, 1930, 46 Stat. L. 376.)

R. S. 4887
Section 32. Inventions Previously Patented Abroad.

No person otherwise entitled thereto shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented by the inventor or his legal representatives or assigns in a foreign country, unless the application for said foreign patent was filed more than twelve months, in cases within the provisions of section forty-eight hundred and eighty six of the Revised Statutes, and six months in cases of designs, prior to the filing of

the application in this country, in which case no patent shall be granted in this country.

An application for patent for an invention or discovery or for a design filed in this country by any person who has previously regularly filed an application for a patent for the same invention, discovery, or design in a foreign country which, by treaty, convention, or law, affords similar privilege to citizens of the United States shall have the same force and effect as the same application would have if filed in this country on the date on which the application for patent for the same invention, discovery, or design was first filed in such foreign country, provided the application in this country is filed within twelve months in cases within the provisions of section forty-eight hundred and eighty-six of the Revised Statutes, and within six months in cases of designs, from the earliest date on which any such foreign application was filed. But no patent shall be granted on an application for patent for an invention or discovery or a design which had been patented or described in a printed publication in this or any foreign country more than two years before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country for more than two years prior to such filing. (R. S. 4887; March 3, 1897, 29 Stat. L. 693; March 3, 1903, 32 Stat. L. 1225; June 19, 1936, 49 Stat. L. 1529.)

R. S. 4892

Section 35. Oath of Applicant.

The applicant shall make oath that he does verily believe himself to be the original and first inventor or discoverer of the art, machine, manu-

facture, composition, or improvement, or of the variety of plant, for which he solicits a patent; that he does not know and does not believe that the same was ever before known or used; and shall state of what country he is a citizen. Such oath may be made before any person within the United States authorized by law to administer oaths, or, when the applicant resides in a foreign country, before any minister, charge d'affaires, consul, or commercial agent holding commission under the Government of the United States, or before any notary public, judge, or magistrate having an official seal and authorized to administer oaths in the foreign country in which the applicant may be, whose authority shall be proved by certificate of a diplomatic or consular officer of the United States. (R. S. 4892; March 3, 1903, 32 Stat. L. 1226; May 23, 1930, 46 Stat. L. 376.)

R. S. 4920

Section 69. Pleading and Proof in Actions for Infringement.

In any action for infringement the defendant may plead the general issue, and having given notice in writing to the plaintiff or his attorney thirty days before, may prove on trial any one or more of the following special matters:

First. That for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect; or,

Second. That he had surreptitiously or unjustly obtained the patent for that which was in fact in-

vented by another, who was using reasonable diligence in adapting and perfecting the same; or,

Third. That it has been patented or described in some printed publication prior to his supposed invention or discovery thereof, or more than two years prior to his application for a patent therefor; or,

Fourth. That he was not the original and first inventor or discoverer of any material and substantial part of the thing patented; or,

Fifth. That it had been in public use or on sale in this country for more than two years before his application for a patent, or had been abandoned to the public.

And in notices as to proof of previous invention, knowledge, or use of the thing patented, the defendant shall state the names of the patentees and the dates of their patents, and when granted, and the names and residences of the persons alleged to have invented or to have had the prior knowledge of the thing patented, and where and by whom it had been used; and if any one or more of the special matters alleged shall be found for the defendant, judgment shall be rendered for him with costs. And the like defenses may be pleaded in any suit in equity for relief against an alleged infringement; and proofs of the same may be given upon like notice in the answer of the defendant, and with the like effect. (R. S. 4920; March 3, 1897, 29 Stat. L. 692.)

R. S. 4923

Section 72. Patent Not Void for Previous Use of Thing in Foreign Country.

Whenever it appears that a patentee, at the time of making his application for the patent, be-

lieved himself to be the original and first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery, or any part thereof, having been known or used in a foreign country, before his invention or discovery thereof, if it had not been patented or described in a printed publication. (R. S. 4923.)

RULES OF PRACTICE IN THE UNITED STATES PATENT OFFICE

Rule 126.

The examiner of interferences or the board of appeals may, either before or in their decision on the question of priority, direct the attention of the Commissioner to any matter not relating to priority which may have come to their notice, and which, in their opinion, establishes the fact that no interference exists, or that there has been irregularity in declaring the same (rule 122), or which amounts to a statutory bar to the grant of a patent to either of the parties for the claim or claims in interference. The Commissioner may suspend the interference and remand the case to the primary examiner for his consideration of the matters to which attention has been directed. From the decision of the Examiner appeal may be taken as in other cases. If the case shall not be so remanded, the primary examiner will, after judgment consider any matter affecting the rights of either party to a patent which may have been called to his attention, unless the same shall have been previously disposed of by the Commissioner.

STATUTORY HISTORY OF R. S. 4886

The Patent Act of 1790 (1 Stat. 109) §1 thereof provided for the grant of Letters Patent—

> ". . . That upon the petition of any person or persons . . . setting forth, that he, she, or they, hath or have invented or discovered any useful art, manufacture, engine, machine, or device, or any improvement therein not before known or used, . . ."

The Patent Act of 1793 (1 Stat. 318) §1 repealed the act heretofore made (Patent Act of 1790) and provided—

> "That when any person or persons, being a citizen or citizens of the United States, shall allege that he or they have invented any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement on any art, machine, manufacture or composition of matter, not known or used before the application, and shall present a petition to the Secretary of State, signifying a desire of obtaining an exclusive property in the same, and praying that a patent may be granted therefor . . ."

The Patent Act of 1800 (2 Stat. 37) §1 extended the privilege of obtaining patents for useful discoveries and inventions, to certain persons therein mentioned, providing—

> "That all and singular the rights and privileges given, intended or provided to citizens of the United States, respecting patents for new inventions, discoveries, and improvements, by the act, entitled 'An act to promote the progress of useful arts, and to repeal the act heretofore made for

that purpose', shall be, and hereby are extended and given to all aliens who at the time of petitioning in the manner prescribed by the said act, shall have resided for two years within the United States, which privileges shall be obtained, used, and enjoyed, by such persons, in as full and ample manner, and under the same conditions, limitations and restrictions, as by the said act is provided and directed in the case of citizens of the United States. **Provided always,** That every person petitioning for a patent for any invention, art or discovery, pursuant to this act, shall make oath or affirmation before some person duly authorized to administer oaths before such patent shall be granted, that such invention, art or discovery hath not, to the best of his or her knowledge or belief, been known or used either in this or any foreign country; and that every patent which shall be obtained pursuant to this act, for any invention, art or discovery, which it shall afterwards appear had been known or used previous to such application for a patent, shall be utterly void."

The Patent Act of 1836 (5 Stat. 117) §6 repealed the foregoing, providing—

"That any person or persons having discovered or invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement on any art, machine, manufacture or composition of matter, not known or used by others before his or their discovery or invention thereof, and not, at the time of his application for a patent, in public use or on sale, with his consent or allowance, as the inventor or discoverer, and shall desire to obtain an exclusive

property therein, may make application in writing to the Commissioner of Patents, expressing such desire, and the Commissioner, on due proceedings had, may grant a patent therefor . . ."

The Consolidated Patent Act of 1870 (16 Stat. 198) in turn repealed the Act of 1836, §24 of the Act of 1870 providing—

"That any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereof, not known or used by others in this country, and not patented, or described in any printed publication in this or any foreign country, before his invention or discovery thereof, and not in public use or on sale for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the duty required by law, and other due proceedings had, obtain a patent therefor."

With the enactment in 1874 of the Revised Statutes, §24 of the Consolidated Patent Act of 1870 became, without change, R. S. 4886.

The Act of 1897 (29 Stat. 692) amended R. S. 4886 to read as follows:

"Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, not known or used by others in this country, before his invention or discovery thereof, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, or more than two years prior to his application, and not

in public use or on sale in this country for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor."

The amendment to R. S. 4886, by the Act of May 23, 1930 (46 Stat. 376) relating to plant patents, is not here pertinent.

STATUTORY HISTORY OF R. S. 4887

R. S. 4487 had its origin in §8 of the Patent Act of 1836, which provided in part as follows:

"But nothing in this act contained shall be construed to deprive an original and true inventor, of a right to a patent for his invention by reason of his having previously taken out Letters Patent therefor in a foreign country, and the same having been published, at any time within six months next preceding the filing of his specification and drawings."

The Patent Act of 1839 (5 Stat. 353) §6 amended §8 of the Patent Act of 1836 to read as follows:

"That no person shall be debarred from receiving a patent for any invention or discovery, as provided in the act approved on the fourth day of July, one thousand eight hundred and thirty-six, to which this is additional, by reason of the same having been patented in a foreign country more than six months prior to his application: **Provided,** That the same shall not have been introduced into public and common use in the United States, prior to the application for such patent: **And Provided, also**, That in all cases every such

patent shall be limited to the term of fourteen years from the date or publication of such foreign letters patent.

The Consolidated Patent Act of 1870 (16 Stat. 198) §25 again changed the provision to read:

> "That no person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid, by reason of its having been first patented or caused to be patented in a foreign country; **provided** the same shall not have been introduced into public use in the United States for more than two years prior to the application, and that the patent shall expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term; but in no case shall it be in force more than seventeen years."

With enactment of the Revised Statutes in 1874 this Section, with certain modifications, became R. S. 4887, as follows:

> "No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid, by reason of its having been first patented or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States for more than two years prior to the application. But every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term, and in no case shall it be in force more than seventeen years."

The Patent Act of 1897 again amended R. S. 4887 to read as follows:

> "No person otherwise entitled thereto shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid, by reason of its having been first patented or caused to be patented by the inventor or his legal representatives or assigns in a foreign country, unless the application for said foreign patent was filed more than seven months prior to the filing of the application in this country, in which case no patent shall be granted in this country."

The Patent Act of 1903 further amended R. S. 4887 to read as follows:

> "No person otherwise entitled thereto shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented by the inventor or his legal representatives or assigns in a foreign country, unless the application for said foreign patent was filed more than twelve months, in cases within the provisions of section forty-eight hundred and eighty-six of the Revised Statutes, and four months in cases of designs, prior to the filing of the application in this country, in which case no patent shall be granted in this country.
>
> "An application for patent for an invention or discovery or for a design filed in this country by any person who has previously regularly filed an application for a patent for the same invention, discovery, or design in a foreign country which, by treaty, convention, or law, affords similar priv-

ileges to citizens of the United States shall have the same force and effect as the same application would have if filed in this country on the date on which the application for patent for the same invention, discovery, or design was first filed in such foreign country, provided the application in this country is filed within twelve months in cases within the provisions of section forty-eight hundred and eighty-six of the Revised Statutes, and within four months in cases of designs, from the earliest date on which any such foreign application was filed. But no patent shall be granted on an application for patent for an invention or discovery or a design which had been patented or described in a printed publication in this or any foreign country more than two years before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country for more than two years prior to such filing."

R. S. 4887 is at present as above amended with the exception of the amendment by the Act of 1936 (49 Stat. 1529) providing for the extension of the convention period in cases of designs from four to six months.

STATUTORY HISTORY OF R. S. 4923

R. S. 4923 first appears as a portion of §15 of the Patent Act of 1836, providing:

"... That whenever it shall satisfactorily appear that the patentee, at the time of making his application for the patent, believed himself to be the first inventor or discoverer of the thing patented, the same shall not be held to be void on

account of the invention or discovery or any part thereof having been before known or used in any foreign country, it not appearing that the same or any substantial part thereof had before been patented or described in any printed publication . . .''

The foregoing portion of §15 of the Patent Act of 1836 was somewhat changed and became §62 of the Consolidated Patent Act of 1870, reading:

''That whenever it shall appear that the patentee, at the time of making his application for the patent, believed himself to be the original and first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery, or any part thereof, having been known or used in a foreign country, before his invention or discovery thereof, if it had not been patented or described in a printed publication.''

In 1874 with the enactment of the Revisted Statutes, §62 of the Consolidated Patent Act of 1870 became R. S. 4923 with the opening phrase beginning with ''That whenever it shall appear that the patentee'' changed to ''Whenever it appears that a patentee''. R. S. 4923 has not since been changed.



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IN THE

Supreme Court of the United States

No. 441, October Term, 1938.

THE ELECTRIC STORAGE BATTERY COMPANY,

Petitioner,

vs.

GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION,

Respondents.

REPLY BRIEF FOR RESPONDENTS.

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INDEX.

PAGE

POINT I—Under all the pertinent patent statutes, it is clear that a patentee may prove acts done in a foreign country to antedate an alleged prior use in this country where there is no contest for patent rights to the same invention involving priority of invention 1

POINT II—Reply to petitioner's argument on concealment in Point II of its reply brief 12

POINT III—Reply to petitioner's argument on public use under Point III of its reply brief 16

CONCLUSION 23

APPENDIX 25

AUTHORITIES CITED:

American Caramel Co. v. Thomas Mills & Bros., 149 F. 743 21

Barrett Co. et al. v. Koppers Co. et al., 22 F. (2d) 395 8

Brown et al. v. Piper, 91 U. S. 37, 44 12

Bryce Bros. Co. v. Seneca Glass Co., 140 F. 161, 172 ..... 20, 21

Commission v. Havemeyer, 296 U. S. 506, 509 8

Corbin & Co. v. United States, 181 F. 296, 304 17

Corona Co. v. Doran Co., 276 U. S. 358, 383 9

Dunbar v. Myers, 94 U. S. 187 12

Egbert v. Lippmann, 104 U. S. 333 19

Ellis v. State, 128 Wis. 513, 524 17

Gandy v. Main Belting Company, 143 U. S. 587, 592, 593 14

Hall v. Macneale, 107 U. S. 90, 97 20

Hall v. Shimadzu, 59 F. (2d) 225, 228 9

Hanifen v. Godshalk, 78 F. 811 4

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PAGE

Helvering v. *Gowran*, 302 U. S. 238, 245 8
Helvering v. *Pfeiffer*, 302 U. S. 247, 252, 253 8

Langnes v. *Green*, 282 U. S. 531, 538 8
Lauder v. *Crowell*, 1879 C. D. 177 10
Liverpool etc. Co. of Liverpool, England, v. *Nebraska Storage Warehouses*, 96 F. (2d) 30, 36 17

Mason v. *Hepburn*, 13 App. D. C. 86, of 1898 15
Milburn Co. v. *Davis Co.*, 270 U. S. 390, 402 5
Missouri v. *Ross*, 299 U. S. 72, 75 4
Morgan v. *Daniels*, 153 U. S. 120 7

Peerless Roll Leaf Co. v. *H. Griffin & Sons Co.*, 29 F. (2d) 646, 648 21

Radio Corp. v. *Radio Lab.*, 293 U. S. 1 7
Rubber Company v. *Goodyear*, 76 U. S. 788, 801 12

Sessions v. *Romadka*, 145 U. S. 29, pages 41-42 4
Slawson v. *Grand Street R. R. Co.*, 107 U. S. 649 12
Stelos Co. v. *Hosiery Motor-Mend Corp.*, 295 U. S. 237. 8
Stresau v. *Ipsen*, 77 Fed. (2d) 937, 943 15

Twyman v. *Radiant Glass Co.*, 56 F. (2d) 119 19

Walker on Patents (Deller's Edition), page 300 3

STATUTES AND MISCELLANEOUS CITATIONS:

Commissioner's Decision, Vol. 21, pp. 227, 228 ..... 11, 27
Patent Act of 1836 5
Patent Act of 1870 6
R. S. 4886 ..... 1, 2, 3, 4, 5, 6, 11, 12
R. S. 4887 ..... 2, 10, 12
R. S. 4892 5
R. S. 4920 5
R. S. 4923 ..... 2, 3, 6
Rule 110, Patent Office Rules 10, 26
36 U. S. P. Q. 25 13

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Respondents.

REPLY BRIEF FOR RESPONDENTS.

POINT I.

Under all the pertinent patent statutes, it is clear that a patentee may prove acts done in a foreign country to antedate an alleged prior use in this country where there is no contest for patent rights to the same invention involving priority of invention.

Petitioner, in its reply brief under this Point, has presented additional argumentative subject matter which is fallacious in its entirety by reason of petitioner's failure to consider all of the pertinent provisions of R. S. 4886 and particularly that which requires that prior knowledge and use in this country of an invention, to be effective to invalidate a patent, must have existed *before the patentee's date of invention or discovery.** If this section provided that the invention must not have been "known or used by

* Emphasis throughout ours.

others in this country before his invention or discovery thereof, but, in the case of an invention made in a foreign country, before the filing in this country of an application for patent therefor, or before any date to which an applicant may be entitled under R. S. 4887," it would then clearly be susceptible of the construction urged by petitioner. But, R. S. 4886 contains no such provision. Consequently the precise issue is that set forth in respondents' main brief at page 10.

Petitioner is also under the erroneous assumption that "prior knowledge or use" is entitled to the same status, under R. S. 4886, as an invention for which a patent application has been filed or which has been patented and that such "prior knowledge or use" is, therefore, entitled to the same protection against foreign knowledge or use. This argument is not only unauthorized by the patent statutes, but overlooks the primary object thereof. The fundamental purpose of R. S. 4886 is to define the conditions upon which patentable inventions may be patented and not to define or protect prior knowledge or use. Such matters are specified as conditions negativing the novelty of inventions for which patents are sought.

Certainly petitioner is unable to cite any section of the patent statutes sustaining its position that prior knowledge or use is entitled to the same protection as a patent application or a patent, as against foreign knowledge or use, in a case not involving priority rights for the same invention. On the contrary the specific wording of R. S. 4886 clearly permits a patentee to establish his date of invention or discovery without limitation as to time or place, where no interference question under R. S. 4923 is involved. There is no limitation in any section of the patent statutes

against a foreign inventor's right to establish antedating activities abroad to overcome the defenses of prior knowledge or use, prior patenting or prior description in a printed publication, whether domestic or foreign. The only limitation against admitting proof of acts in a foreign country under R. S. 4886 and 4923 is when such foreign activities are relied upon to render "void" a United States patent, or to defeat a patent application in an interference contest, for the same "thing patented" (R. S. 4923).

The authorities have uniformly so held. Walker on Patents (Deller's Edition), page 300 states:

> "When a patent is questioned in point of novelty, and when that question depends upon the date of invention claimed in that patent, it is not material whether the event, which constituted that invention, occurred in the United States or in some other country (*Welsbach Light Co.* v. *American Incandescent Lamp Co.*, 98 Fed. 613 (1899); *Badische Anilin & Soda Fabrik* v. *Klipstein & Co.*, 125 Fed. 543, C. C. S. D. N. Y. (1903); *Claude Neon Lights* v. *Rainbow Lights*, 47 F. (2d) 345, 346, D. C. E. D. N. Y. (1931)."

This rule is not anomalous nor unreasonable. The law looks with disfavor upon forfeiture. The manifest intent of the Congress in barring the anticipatory effect of unpublished, unpatented foreign knowledge or use to invalidate a United States patent, or an application therefor, and not subjecting the patentee's countervailing proofs to the forfeiture provisions or bars of the patent statutes, is in conformity with this general rule of law.

Notwithstanding the consistent interpretation of the statutes by the courts since 1896, the date of the

decision in *Hanifen* v. *Godshalk*, 78 F. 811, as advanced by respondents here, the Congress has not amended R. S. 4886 to give it the construction advanced by petitioner, even though the Congress amended R. S. 4886 as late as 1930 in other particulars. This is persuasive that the Congress adopted the judicial construction given by the courts in infringement suits that a patentee may introduce proofs of acts abroad to antedate an alleged prior use here. This court stated in *Sessions* v. *Romadka*, 145 U. S. 29, 41-42, that where a certain construction had been given to specific sections of the patent statutes by this Court, and the Congress in a subsequent revision of these sections re-inserted the same language, the Congress "must be considered to have adopted also the construction given by this court to this sentence, and made it a part of the enactment".

Again in *Missouri* v. *Ross*, 299 U. S. 72, 75, this Court said:

> "Moreover, Congress in the face of these decisions has permitted the clause as it now appears in paragraph (6) to stand for many years without change in its phraseology, although amending that portion of the Bankruptcy Act in other particulars. This is persuasive evidence of the adoption by that body of the judicial construction. *United States* v. *Ryan, supra*, at page 175; *Sessions* v. *Romadka*, 145 U. S. 29, 41-42."

Petitioner bases its whole theory (pp. 2 to 5 of its Reply Brief) as to the important position of an alleged prior "user" or "originator" under R. S. 4886, upon two erroneous premises. First, even though the alleged "user" (Hall) might have been an independent originator in the sense that he derived no knowledge of the process from the true inventor, yet he

was not both an "original and first" inventor. The use of the language "original and first inventor" occurs in other pertinent statutes, such as R. S. 4920—4th paragraph, and R. S. 4892. Respondents submit that this language, especially as used in Section 4920, cannot be ignored. This Court stated in *Milburn Co.* v. *Davis Co.*, 270 U. S. 390, 402, "The fundamental rule, we repeat, is that the patentee must be the first inventor".

Certainly if the strictest interpretation be given to all these statutes combined, especially as to the meaning of the term "original and first inventor", the patentee, Shimadzu, meets *all requirements*, whereas petitioner's alleged prior user, Hall, does not in the instant situation where prior knowledge or use in a foreign country is not being urged to invalidate a United States patent, or where the question of Hall's right to a patent is not in issue.

Second, petitioner on page 2 of its reply brief gives an unwarranted and unfair meaning to the clause only half quoted from R. S. 4886 "not known or used by others in this country". It is only when the entire clause "not known or used by others in this country before his invention or discovery" is read that the real meaning appears. In construing this statute it is important to note the following acts and omissions of the Congress:

1. By the Act of 1836, the Congress amended the Statute to allow patents to citizens of foreign countries.

2. It amended the Statute to make the critical date prior to which a use must exist to become a statutory bar to the grant of a patent, the date of the inventor's "invention or discovery thereof", rather than the application date (1836).

3. In the amendment of 1870, Congress added the words "in this country" to limit the place of the knowledge or use which would bar the grant of a patent.

4. Neither in the amendment of 1870 nor at any time, then, has Congress limited the requirement that an alleged prior use must have existed prior to the date of the invention or discovery to those cases only where the invention is made in this country.

It is, therefore, clear from these amendments that petitioner's contention that a prior user is entitled to the same protection under R. S. 4886 against foreign knowledge and use as the inventor of a patentable invention is wholly unwarranted.

The correctness of respondents' position as to the construction which the Congress intended R. S. 4886 to be given is obvious at once from an application of the clauses thereof in controversy to a specific situation, as follows:

> "Any person" (for example, a Canadian residing in Canada) having made an invention "not known or used by others in this country" (the United States) "before his" (the Canadian's) "invention or discovery thereof" (in Canada) may obtain a valid patent therefor.

Naturally, petitioner would like to have this infringement suit resolve itself into a contest of priority for the same patent rights, since in that event the case would come squarely within the provisions of R. S. 4923. Then in order to protect petitioner's *patent* rights, or the "thing patented" (R. S. 4923) the knowledge and use in a foreign country would have no effect.

However, on such an issue, Hall and petitioner are one, petitioner having stated (R. I. 94):

> "The parties to this infringement suit are the same as the parties to the interference *Hall* v. *Shimadzu* decided by the Court of Customs and Patent Appeals, 59 Fed. (2d) 225."

and at R. I. 106:

> "In the Patent Office proceedings Hall, in whose shoes Defendant stands, introduced testimony * * *."

After petitioner had its day in court in the interference and lost, it then amended its own claims in order to obtain and accept a limited patent, thus forfeiting all further claim to the inventions here in issue, under the well known doctrine of estoppel by its file wrapper history.

Again, where the parties here are the same as those involved in the interference, the issue of "prior inventorship" has been settled in favor of respondents under the doctrine enunciated by this Court in *Morgan* v. *Daniels*, 153 U. S. 120, and *Radio Corp.* v. *Radio Lab.*, 293 U. S. 1.

No additional or different proof from that adduced by petitioner in the interference of the quantity, quality or character, sufficient to satisfy the rule enunciated by the foregoing authorities, is present in this case. No explanation has been offered by petitioner that such additional evidence as it introduced here was not available to it during the interference. As a matter of fact petitioner refused to offer such evidence in the interference even though specifically requested by respondents (PX 41, pp. 55, 60, 61).

Petitioner having withheld such evidence should not now be permitted to obtain any benefit therefrom. *Barrett Co. et al.* v. *Koppers Co. et al.*, 22 Fed. (2d) 395.

While respondents are not unmindful of the rule that in the absence of a cross writ of certiorari they cannot complain here of an erroneous decision below, nevertheless they are not estopped from urging the correct ground upon which to support the decisions below. *Langnes* v. *Green*, 282 U. S. 531, 538; *Stelos Co.* v. *Hosiery Motor-Mend Corp.*, 295 U. S. 237; *Commission* v. *Havemeyer*, 296 U. S. 506, 509; *Helvering* v. *Gowran*, 302 U. S. 238, 245; *Helvering* v. *Pfeiffer*, 302 U. S. 247, 252, 253.

The additional proofs introduced by petitioner in this case did not offset the fact that petitioner did not have a successful reduction to practice because the material "caught fire right along" as the record shows (PX 41, p. 91). Thus Kohl, one of petitioner's witnesses, stated (PX 41, p. 90) that in 1929, when the production was "very, very small" work was continued on the mills "until three years after that time we got it up to maybe seven or eight hundred pounds an hour". During this time they had "lots of" difficulties with the "mechanical operations and the drives and we had to make various changes in the driving of the mill; also in changing the method of feeding the balls into the mill, and changes on the end in order to get the stuff out of the mill. All those changes I cannot recall what they were, but there were many."

It was obviously during this period that the material "caught fire right along" as stated by this witness.

Petitioner's witness Shaw also stated (PX 41, p. 79):

> "Another time it caught fire, had trouble with the drives—mechanical trouble."

A third witness, Lattman, testified (PX 41, pp. 86, 87) as follows:

> "Q. Do you remember whether it ever took fire? A. I know it caught fire.
>
> Q. That is, the material inside? A. The material inside."

In view of this evidence it is not surprising that the Court of Customs and Patent Appeals stated in *Hall* v. *Shimadzu* interference, 59 F. (2d) 225, 228:

> "We are of the opinion that the Board of Appeals committed no error in finding that * * * the record is insufficient to establish conception or reduction to practice of the subject-matter of the counts by appellant (Hall) prior to appellee's (Shimadzu's) filing date."

The mere fact that on one day in June, 1921, petitioner may have run the mill on a commercial scale does not offset the decisions of the Patent Office and Court of Customs and Patent Appeals because subsequent events clearly show petitioner was not satisfied, but made further elaborate tests which required many changes in the apparatus and process (see our main brief, pp. 56-58).

One of the main features of reduction to practice is to demonstrate the success of an invention. Thus, this Court stated in *Corona Co.* v. *Dovan Co.*, 276 U. S. 358, 383, that a process is reduced to practice

when it is "successfully" performed. However, as late as December, 1921, petitioner was still experimenting along lines leading in the wrong direction of using less air but increasing the peripheral speed. When the Hall application was filed nearly three years later, a complete change was made, and the air flow was increased nearly 500%. As to when this important change was made in actual practice, the record is entirely silent, although all the facts were within the knowledge of petitioner.

Petitioner's statements (Reply Brief, p. 3) that the amendment of R. S. 4887 of 1903 would serve no useful purpose under respondents' views, are not correct. The effect of filing of an application on the main issue of "priority of invention" is only one of five essential factors to be considered in a determination of priority. Thus (1) conception, (2) disclosure, (3) diligence, (4) actual reduction to practice, as well as (5) the effect of the filing of the application are all elements establishing priority. The 1903 amendment merely added to the effect of *one* of these five factors. (See Rule 110 of the Patent Office Rules of Practice.)

In petitioners' reply brief, at page 7, a criticism is advanced against respondents' statement that written description in a foreign application is evidence of conception on the ground that no authority is given in support thereof. This support is found in the sequel (printed in the Appendix hereto) to a Patent Office interference case cited by petitioners, *Lauder* v. *Crowell*, 1879 C. D. 177. In that case both inventions occurred in a foreign country. Notwithstanding the Patent Office interference practice excluding fact testimony of acts done abroad, a motion

to take testimony abroad was made and granted. In Volume 21, pages 227, 228 of the Commissioner's decision, the Commissioner stated:

> "By means of this testimony and the accompanying exhibits, it is now conclusively shown that Percy D. Hedderwick, applicant in this case is the person of that name mentioned in the English patent, No. 1581, for the year 1870, the completed specification of which was filed November 30, 1870, and that he *is the original and true inventor of the matter here at issue.* Giving the utmost effect to the proofs presented by Duncan, Wilson and Lauder, the earliest date to which they would be entitled, is that of the filing of their completed English specification May 16, 1871. This, however, *is subsequent* to the date *of invention proven* by Hedderwick's English patent, and *in his favor priority of invention is accordingly awarded.* The decision of the Board of Examiners-in-Chief is now affirmed.
>
> E. M. Marble, Com. of Pat.
>
> July 10, 1880."

In view of the foregoing arguments the additional argumentative subject matter presented by petitioner under Point I in its reply brief is entirely irrelevant to any issue here presented, as the same clearly overlooks that portion of R. S. 4886 which makes fundamental the requirement that prior knowledge and use of an invention in this country, in order to invalidate a patent must have existed before the date of the invention or discovery. Shimadzu completed his invention in August, 1919, long before the date of any knowledge or use thereof by others in this country. He was therefore, in fact, as well as in law the "first"

inventor, and under R. S. 4886 his patents are clearly valid as the courts below concurrently held. Unless and until R. S. 4886 is amended to provide that in respect of inventions made in foreign countries, knowledge and use thereof in this country prior to the date of application for patent therefor in this country or prior to any date to which an application may be entitled under R. S. 4887, will bar the grant of a valid patent, petitioner's contention is without basis in law.

POINT II.

Reply to petitioner's argument on concealment in Point II of its reply brief.

(1) *Rubber Company* v. *Goodyear*, 76 U. S. 788, 801, plainly decided that a *defense* which had not been pleaded could not be availed of after the trial. True, in that case the specific defense involved was that the devices had not been marked "Patented" but the principle is identical with that here involved, and the same rule of law is here applicable. Petitioner excuses its failure to plead concealment on the ground that it mistakenly assumed that the patents in suit were invalid because of certain Japanese patents, but both lower courts have found to the contrary. Merely because of petitioner's mistaken assumption below, it should not be permitted to raise this defense *de novo* here.

The cases relied on by petitioner (Reply Brief, p. 11)—*Slawson* v. *Grand Street R. R. Co.*, 107 U. S. 649, *Dunbar* v. *Myers*, 94 U. S. 187, and *Brown et al.* v. *Piper*, 91 U. S. 37, 44, do not support its

position. Those cases did not deal with affirmative defenses but with situations where the inventions described in the patents and the bills were plainly not patentable,—a question of law which the court could determine from within the four corners of the patents and which required no affirmative defense. Such cases hold indeed that the court can of its own motion dismiss a bill where lack of patentable novelty appears on the face of the patent.

Petitioner argues that the invalidity of the patents in suit appears from the face of the opinions below, but those opinions are based on the facts pleaded, including the defenses, and the evidence taken in support of the pleadings—hardly an analogous situation. Moreover, after the opinion was filed by the District Judge, two rehearings were had before him, one on motion of petitioner and one on motion of respondents. On neither of these motions was the question of concealment raised (R. II. 1189; 36 U. S. P. Q. 25).

The quotation from the District Court's opinion (Petitioner's Reply Brief, p. 11) shows that the question of concealment was not tried before the court. Neither was this point argued or raised in the briefs before the Circuit Court of Appeals.

Obviously, because of petitioner's failure to plead this defense, or to introduce evidence directed to it, or to urge it in its arguments or briefs, it should not be considered now.

(2) Petitioner in its reply brief (pp. 12, 13) misconceived the purpose of respondents' reference to Shimadzu's December, 1920, application. Reference to this application was made by respondents as an incident to show that Shimadzu's activities through-

out were inconsistent with, and conclusively rebut, any attempt to conceal or withhold his inventions. Intention is an important element of the doctrine of concealment, which is based on the theory of abandonment.

The fact that Shimadzu reduced his invention to practice in 1919 and in 1920 was producing for commercial purposes, does not detract in any way from the rule of law that a patentee is entitled to further time for the development of his machine or process from a business point of view before he files his application. In *Gandy v. Main Belting Company*, 143 U. S. 587, 592, 593, this Court said:

> "Taking all these provisions of the patent law together, we think it was manifestly the intention of Congress that the right of the patentee to his invention should not be denied by reason of the fact that he had made use of it, or put it on sale abroad, more than two years before the application, provided it were not so used or sold in this country."

On page 14 of its reply brief petitioner speaks of Shimadzu withholding his invention from the American public for years after June, 1920. However, the record shows that in addition to the application filed in December, 1920, in January, 1922, he filed his application for United States Patent No. 1,584,149, held valid and infringed; in February, 1923, he filed his application for United States Patent No. 1,584,479, in which he described the process of simultaneous oxidation and abrasion of lead pieces into a fine powder. In July, 1923, he filed his application for United States Patent No. 1,584,150. This is hardly a history of suppression and concealment. Hall, on

the contrary, claims to have reduced his invention to practice in June, 1921, but failed to file any application for patent until March, 1924. When his application was allowed with limited claims, he permitted it to be forfeited and only had it reinstated after Shimadzu's United States patents were published in this country.

Moreover, in all patent cases where the doctrine of concealment has been applied, beginning with *Mason* v. *Hepburn*, 13 App. D. C. 86, of 1898, through *Stresau* v. *Ipsen*, 77 Fed. (2d) 937 (1935), it will be found that an incitation or spurring to activity by the early inventor due to the knowledge of the entrance of a rival in the field has become an essential element thereof. Thus in *Mason* v. *Hepburn*, the court stated that the first inventor probably forgot all about the invention, that "as a thing of value it had passed out of his mind" and was only recalled when he saw a publication of a patent to a rival in the Patent Office Official Gazette. In the recent case of *Stresau* v. *Ipsen*, this doctrine was elaborated upon after a review of the applicable cases, the court there stating (p. 943):

> "A careful examination of the cases so cited discloses that in each of them the factor of incitation to activity was, in fact, found to be present.
>
> * * *
>
> The first inventor, in fact, is presumed to be the first inventor in law; the patent statutes contemplate that the first inventor of a patentable device or process shall receive patent therefor, and, generally speaking, his right thereto may not be defeated by a subsequent inventor, or by the public, unless an abandonment of the right on the part

of such first inventor be shown. *Rolfe* v. *Hoffman*, 26 App. D. C. 336, 344; *Hubbard* v. *Berg*, 40 App. D. C. 577; *Townsend* v. *Smith*, 36 F. (2d) 292, 294, 17 C. C. P. A. (Patents) 647, with their appropriate citations."

In the instant case petitioner has made no attempt to show that Shimadzu was incited to activity by any knowledge of any kind whatever in respect of the activities of petitioner and Hall or of any one else. Therefore, it necessarily follows that petitioner's alleged defense on this ground fails.

POINT III.

Reply to petitioner's argument on public use under Point III of its reply brief.

To argue that the District Judge, when he spoke of commercial production in 1921 by the Hardinge Mill, meant public use, is wholly unwarranted. Plainly, what the District Judge meant by commercial production was production on a commercial scale as against a laboratory scale, for there is not one iota of evidence in the case to show that any of the leaden powder produced during the year 1921 by Hall in his mill was used on plates installed in batteries sold to the public by petitioner. In fact, the evidence is all to the contrary. The log sheets (DX 61, 62, 63, 64) plainly show that petitioner was experimenting for some time thereafter with all possible variations in load, speed of revolution, quantity of air and degree of oxidation.

Moreover, Hall's witnesses admitted in the interference that for the period 1921 to 1923 the lead balls

were coming out with the powder at the discharge end of the mill and that the mill frequently caught on fire (PX 41, pp. 79, 87, 90, 91, 92).

Again, as late as December, 1921 (DX 63) Hall was travelling in a direction diametrically opposed to the proper one in that he was decreasing the insignificant amount of air with which he theretofore had been experimenting, whereas it was only by increasing it many fold that he eventually successfully completed his process.

Why refer to Cooper and Nagel, who worked for petitioner sometime between 1923 and 1930 to argue that petitioner's process was public in 1921? The presumptions advanced by petitioner (pp. 16, 17 of its Reply Brief) have no retroactive effect. No presumptions with respect to Cooper's activities in 1923 can have any evidentiary value as to the operation of petitioner's plant in 1921.

Thus in *Ellis* v. *State*, 128 Wis. 513, 524, the court stated:

> "It is an elementary principle of evidence that, as a general rule, presumptions do not run backward."

In *Corbin & Co.* v. *United States*, 181 Fed. 296, 304 (C. C. A. 6), the court stated:

> "We do not understand the rule of presumptive evidence to be that if and when the existence of a given condition is proven there is a presumption that it had existed previous to that time."

See also *Liverpool etc. Co. of Liverpool, England* v. *Nebraska Storage Warehouses*, 96 Fed. (2) 30, 36 (C. C. A. 8), where the same rule of law is reiterated.

Moreover, there is no basis for relying on a mere presumption when evidence of the real facts is in the possession of petitioner who failed to produce it.

Petitioner's belated claim that there was any element of publicity whatsoever in respect of any of petitioner's activities during the critical period is further shown to be unjustified by affidavits and statements made by petitioner in opposition to respondents' motion to inspect petitioner's plant. Thus petitioner's President, Williams, stated (R. I. 68) that petitioner employs a large staff of capable technical experts and has developed and improved to a high degree of efficiency the methods of producing the product in question, and that:

> "The set-up and arrangement of the Defendant's plant is an exceedingly valuable asset in that it reduces or minimizes the cost and insures uniformity of product."

Williams also points out that:

> "No competitors of the Company should be given access to or by inspection obtain the benefit of this time and work and expense and thus cause the Defendant a very substantial injury and loss."

Moreover in the same affidavit (R. I. 68) Williams stated that:

> "Since 1895 and for a very substantial consideration the Defendant has had an agreement with the Accumulatoren-Fabrik Aktiengesellschaft, a German corporation, the largest manufacturers of storage batteries in Continental Europe, whereby engineering and technical information and new developments are exchanged between the two companies."

It would be entirely inconsistent with the letter and spirit of such an agreement for petitioner to permit a valuable process such as that here involved, to become public property.

Again petitioner's counsel (R. I, 105) in the memorandum opposing respondents' petition to inspect petitioner's plant pointed out that petitioner was entitled to protection against "impertinent intrusion". If the plant was open to the inspection of the public, as petitioner now claims, it is obvious that such objection to inspection would never have been advanced by petitioner.

The above facts indicate quite clearly the privacy in which petitioner maintained its activities. As against these, the record fails to show a single circumstance indicating that the slightest color of publicity can be attached thereto. When it is remembered that the defense of public use must be proven beyond a reasonable doubt, it will be seen that this defense must fail.

On page 17, in referring to *Twyman* v. *Radiant Glass Co.*, 56 Fed. (2d) 119, petitioner fails to point out that the ground on which the court held public use was that great numbers of the glass cylinders were unconditionally sold to the public and not made for experimental purposes but mainly for the purposes of trade.

In *Egbert* v. *Lippmann*, 104 U. S. 333, the device embodying the invention was furnished on two different occasions to a woman for use. It was exhibited and explained to another person. The inventor waited eleven years before filing his application. The invention had, in the meantime, found its way into

almost universal use. The court held that the inventor, having learned from this general use that there was some value to his invention, could not by his application acquire rights which he had clearly dedicated to the public.

In *Hall* v. *Macneale*, 107 U. S. 90, 97, referred to on page 17, petitioner fails to point out that three of the safes containing the bolts in question, were actually and unconditionally sold and two were exhibited at fairs.

Petitioner misconceives the purport of respondents' statements on pages 56, 58 of their main brief, showing that petitioner's uses from 1921 to 1923 were experimental in character. These statements show that Hall was experimenting and testing out his invention in order to demonstrate its commercial utility and therefore his acts were not a public use.

That the rule as to public use is very different in the case of a machine or process from that of a product is clearly pointed out in *Bryce Bros. Co.* v. *Seneca Glass Co.*, 140 Fed. 161, at page 172, where the court said:

> "These principles strike me with great force as being sound and reasonable, and from them I am fully persuaded that a clear distinction must be drawn between the experimental use allowed of a machine sought to be patented, designed to produce articles, and that of a mere patented article itself, designed for general use or consumption. In the latter case, a presumption arises that, when the inventor issues to the public the article, he regards it as a finished product, and, in case he does not apply for patent within two years after, abandonment of his purpose to

so do may well be assumed. In the case of a machine designed to manufacture articles, on the contrary, reason and common experience teach us that in most cases such a machine will not come at once a perfect product from the first castings. Almost inexplicable defects will generally be found to mar the perfect operation. These defects must frequently be remedied, often by long study and much experimentation. The article itself may be produced by the machine in perfect state or nearly so, yet not quickly, effectively, and practically by reason of the defects in the machine."

In *American Caramel Co.* v. *Thomas Mills & Bros.*, 149 Fed. 743, citing *Bryce Bros. Co.* v. *Seneca Glass Co., supra*, the court in holding that the use of the machine was experimental and there was no public use thereof, even though the caramels made by it were sold to the trade, likewise pointed out this difference.

In *Peerless Roll Leaf Co.* v. *H. Griffin & Sons Co.*, 29 F. (2d) 646 (C. C. A. 2) Judge Learned Hand said (p. 648) in holding that an alleged use was not public:

"So it becomes necessary to decide whether the use was 'public,' within the meaning of Revised Statutes, §4886 (35 USCA §31). We think it reasonably clear that the machines were intended to be kept from the knowledge of the public in general; there could have been no other reason for isolating them in a separate room and allowing access to only three employees. It is true that these three were not expressly pledged to secrecy, and this has at times been regarded as important. *Bliss Co.* v. *Southern Can Co.* (D.

C.) 251 F. 903, 909; and indeed it was doubted in *Perkins* v. *Nashua, etc. Co.* (C. C.) 2 F. 451, whether even an express pledge would serve. It seems to us that a pledge is only one circumstance, and that the question is to be decided by considering whether in fact the use was such as to impart knowledge to the trade at large. We held in *Schrader* v. *Wein Sales Corporation* (C. C. A.) 9 F. (2d) 306, that, when only the inventor and an assistant had access to the machine, no pledge need be proved; it was implicit in the situation. * * *

The cases nearly always also raise the question whether the invention is in process of experiment or testing, and, while this honestly continues, the publicity of the use is not important. *Egbert* v. *Lippman*, 104 U. S. 333, 336, 26 L. Ed. 755; *Elizabeth* v. *Pavement Co.*, 97 U. S. 126, 134, 24 L. Ed. 1000. It is probable that the use at bar was, at least in part, and perhaps altogether, of this kind, but we prefer not to strain that aspect of the evidence. The word 'public' means more than that the use shall not be experimental; it is possible, even after the time of experiment has passed, to practice the invention without abandonment. An inventor working by himself presents a simple case, but we cannot suppose that his rights are greater than those of a company. There must be some way by which they can privately practice their inventions as well as he, and yet any practice involves the knowledge of some employees. When the number of these is limited to as few as are necessary to practice it at all, when customers and the public generally are excluded, and adequate precautions are taken to prevent dispersion of the knowledge until at least two years before application is made, it seems to us enough, whether

a formal pledge of secrecy be exacted or not. Those workmen who will keep it do not need it; those who will not, it will not bind."

CONCLUSION.

The decree of the Court below should be affirmed or, in the alternative, the Writ of Certiorari should be dismissed.

Respectfully submitted,

EDMUND B. WHITCOMB,
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JOSEPH W. HENDERSON,
Counsel for Respondents.

GEORGE H. SOUTHER,
GEORGE YAMAOKA,
Of Counsel.

Dated, February 25, 1939.

APPENDIX.

PAGE

Rule of Practice 110 of the United States Patent Office 26

Interference D—*Hedderwick* v. *Duncan, Wilson & Lauder* 27

Rule of Practice 110 of the United States Patent Office:

"Each party to the interference will be required to file a concise preliminary statement, under oath, on or before a date to be fixed by the office. When the invention was made in the United States the statement should so allege and show the following facts:

(a) The date upon which the first drawing of the invention and the date upon which the first written description of the invention were made.

(b) The date upon which the invention was first disclosed to others.

(c) The date of the first act or acts (other than the acts specified in (a) and (b)) which, if proven, would establish conception of the invention, and a brief description of such act or acts.

(d) The date of the reduction to practice of the invention.

(e) The date when he began actively exercising reasonable diligence in adapting and perfecting the invention.

* * * * * * * * * * * * "

COMMISSIONERS DECISIONS MANUSCRIPT VOL. 21,
PAGES 227-228

United States Patent Office.

Interference D—*Hedderwick* v. *Duncan, Wilson & Lauder.*

Interference F—*Lauder* v. *Hedderwick.*

Appeal from the Board of Examiners-in-Chief.

Re-Hearing

PAPER FOLDING MACHINES

MESSRS. MUNSON & PHILIPP for Hedderwick.
MESSRS. RAKEWELL & KERR for Duncan, Wilson & Lauder.

Interference D

Percy D. Hedderwick (application filed August 16, 1875).
Duncan, Wilson & Lauder (application filed Dec. 10, 1873).

My predecessor in office, on June 6, 1879, rendered a decision in the above entitled interference, reversing the decision of the examiner of interferences and the board of examiners-in-chief and awarding priority of invention to Duncan, Wilson and Lauder. In his decision the following language occurs.

"The result is that Hedderwick's earliest date legally established by the proofs is that of his American application, August 16, 1875. His application is therefore defeated by the English specification of Duncan, Wilson and Lauder of May 16, 1871. If the utmost effect be given to

the testimony of Duncan, Wilson and Lauder, their earliest date is that of their English specification May 16, 1871. But the English specification of Hedderwick of October 14, 1870, is fatal to their application for a patent for an invention made May 16, 1871. If their proof does not fix their date, at the date of their English specification, then it fixes it at the date of their American application December 10th, 1873, which although earlier than that of Hedderwick's application, is later than that of Hedderwick's English specification.

"The judgment of the Board of Examiners-in-Chief awarding priority to Hedderwick is reversed. But no patent will be allowed to either party without further proof. If, at the examination of six months from the date hereof, either party shall have failed to establish by legal proof a date of invention earlier than the date of the English patent of the other party, the interference will without further order, be dissolved, and the application of the parties in default finally rejected."

From this excerpt it will appear that while the English patent of Hedderwick was regarded as containing the invention in controversy and as sufficient to bar the grant of the patent in the absence of further proof to Duncan, Wilson and Lauder, it was also held that Hedderwick had not so introduced the same in evidence as to be entitled to carry back and connect therewith his invention.

The decisions of the lower tribunals were based upon the ground, which was not disputed by counsel, that this patent was properly in evidence.

A motion was subsequently made on behalf of Hedderwick, to take testimony abroad and was granted, and upon interrogatories and cross-interrogatories in proper form the testimony of Percy D. Hedderwick was taken. By means of this testimony and the accompanying exhibits, it is now conclusively shown that Percy D. Hedderwick, applicant in this case is the person of that name mentioned in the English patent, No. 1581, for the year 1870, the completed specification of which was filed November 30, 1870, and

that he is the original and true inventor of the matter here at issue. Giving the utmost effect to the proofs presented by Duncan, Wilson and Lauder, the earliest date to which they would be entitled, is that of the filing of their completed English specification May 16, 1871. This however, is subsequent to the date of invention proven by Hedderwick's English patent, and in his favor priority of invention is accordingly awarded.

The decision of the Board of Examiners-in-Chief is now affirmed.

E. M. MARBLE, Com. of Pat.

July 10, 1880.

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CLERK

IN THE

Supreme Court of the United States

No. 441, October Term, 1938.

THE ELECTRIC STORAGE BATTERY COMPANY,
Petitioner,

vs.

GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION,
Respondents.

Petition for Correction of Opinion and Corresponding Modification of Orders and for Rehearing on One of the Issues Together with Supporting Affidavits Therefor.

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INDEX

Page

I. No Public Use Whatever is Shown in 1921 of the Important Element of "Blowing the Powder Produced Out of the Vessel by the Air Blast" as Specified in Claim 2 of the 1,584,150 Patent 3

II. The Product and Other Claims of the 1,584,150 Patent Not in Litigation Before This Court Cannot Properly Be Invalidated by the Alleged Prior Use—Lower Courts Concurrently Held That the Evidence Did Not Prove That Petitioner's Product Contained the Elements Recited in the Product Claims 5

III. Only Claims 10 and 11 of the 1,896,029 Patent Are in Litigation; Decision of the Court Should Not Invalidate Claims 1 to 9, Each Inclusive—Opinion Should be Corrected to Avoid Any Possible Misunderstanding 7

IV. Claim 2 as Well as Claims 1, 3, 9, 11 and 12 of 1,584,150 Patent Clearly Entitled to the Effective Filing Date as of the 1,584,149 Patent—Hence, Alleged Bar of Two Years Public Use Cannot Apply to These Claims—Claim 2 Specifically Applied to the Disclosure of the 1,584,149 Patent 7

INDEX

Page

V. Claims 10 and 11 of the 1,896,020 Patent Clearly Entitled to the Filing Date of the 1,584,149 Patent. Claim 10 Applied to PX-13, a Drawing Admitted in Evidence by the Courts Below as Representative of the Apparatus Disclosed in the 1,584,149 Patent 15

VI. A Consideration of All the Circumstances Reveals That Petitioner Did Not Plead the Defense of Public Use Based on the 1921-1923 Hardinge Mill Activities; This Court Apparently Overlooked the Total Inadequacy of Petitioner's Proof in Fact, and Under the Authorities to Establish a Public Use, Especially Failing to Note the Clear Line of Distinction Established by the Record Between Petitioner's Experimental and Development Work, Which Was Maintained a Secret, and the Later Operation of Petitioner's Plant 19

APPENDIX

Affidavit of Clarence J. Treston 47-52

Affidavit of John J. Deegan 53-54

Authorities Cited

	Page
Agawam Co. v. Jordan, 7 Wall. 583, 74 U. S. 583	22
Austin Machinery Co. v. Buckeye Traction Ditcher Co., 13 F. (2d) 697, 698	42
Bates v. Coe, 98 U. S. 31, 37, 45-47	22
Beadle v. Bennett, 122 U. S. 71, 76, 77	41
Chapman et al. v. Wintroath, 252 U. S. 126, 137	8
Cleveland Trust Co. v. Schriber-Schroth Co., 92 F. (2d) 330, 336, 305 U. S. 47	42
Commission v. Havmeyer, 296 U. S. 506, 509	29
Eclipse Machine Co. v. Harley Davidson Motor Co., 252 F. 805, 811	42
Edison v. Allis-Chalmers Co. et al., 191 Fed. 837, 843	12
Eibel Process Co. v. Minneapolis & Ontario Paper Co., 261 U. S. 45	28
Elizabeth v. Pavement Co., 97 U. S. 126	41, 42, 43
General Electric Co. v. Independent Lamp & Wire Co., Inc., 267 F. 824, 836	10
Godfrey v. Eames, 1 Wallace 317	9
Harmon v. Struthers, 57 F. 637, 641	42
Hayes-Young Tie Plate Co. v. St. Louis Transit Co., 137 F. 80, 82	11
Helvering v. Gowran, 302 U. S. 238, 245	29
Helvering v. Pfeiffer, 302 U. S. 247, 252, 253	29
Kearner Incinerator Co. v. Townsend Estates, 27 F. (2d) 599, 604	42

	Page
Langnes v. Green, 282 U. S. 531, 583	29
Los Angeles Lime Co. v. Nye, 270 F. 155, 162	42
Manning v. Cape Isinglass & Glue Co., 108 U. S. 462, 465	42
Novadel Process Corp. v. J. P. Meyer & Co., 35 F. (2d) 697	10
Pacific Cable Ry. Co. v. Butte City St. Ry. Co., 55 F. 760, 765	42
Reo Motor Car Co. v. Gear Grinding Machine Co., 42 F. (2d) 965, 968	42
Root v. Third Ave. Railroad Co., 146 U. S. 210, 225	42
Singer v. Braunsdorf, 7 Blatchf, 521, Fed. Case No. 12,897	9
Smith v. Goodyear Dental Vulcanite Company et al., 93 U. S. 486, 501	9
Smith and Gregg Mfg. Co. v. Sprague, 123 U. S. 249, 265	41
Stelos Co. v. Hosiery Motor-Mend Corp., 295 U. S. 237	29
Wendell v. American Laundry Machine Co., 239 F. 555, 558, 248 F. 698	43
Westinghouse Electric Manufacturing Co. v. Saranac Lake Electric L. Co., 108 F. 221, 228	42

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Petition for Correction of Opinion and Corresponding Modification of Orders and for Rehearing on One of the Issues Together with Supporting Affidavits Therefor.

To the Honorable, the Chief Justice and the Associate Justices of the Supreme Court of the United States:

The respondents above named, Genzo Shimadzu and Northeastern Engineering Corporation, respectfully present this petition for a rehearing of the above entitled cause and request this Honorable Court to reconsider its action on April 17, 1939, in reversing the decree of the United States Circuit Court of Appeals for the Third Circuit and in invalidating the United States Letters Patent Nos. 1,584,150 and 1,896,020 and in remanding the cause to the United States District Court for the Eastern

District of Pennsylvania with directions to dismiss the bill as to United States Letters Patent Nos. 1,584,150 and 1,896,020, and to proceed, in the light of the invalidity of said patents, to determine whether United States Letters Patent No. 1,584,149 is valid and infringed.

Out of deference to the practice of this Court, this petition for rehearing of the above entitled case (Opinion of Mr. Justice Roberts of April 17, 1939), will not undertake a reargument of matters already fully developed in the briefs and on the argument to the Court, except that counsel have deemed it advisable to discuss certain features of the doctrine of public use, particularly presenting certain factual considerations which, it is felt, the Court may not have had fully in mind. Aside from the matter of public use, the petition for rehearing discloses certain misapprehensions of the facts established by the Record (points I to V herein), certain errors as to the scope of the issues before the Court (points II and III), and certain matters as to which it is believed the Court overlooked controlling cases in its decision (points IV and V). Counsel for respondents urge that the rights in the respective patents should not be prejudiced on the remand to the District Court by inadvertent errors as to the facts and scope of the issues involved which are believed to have crept into the Opinion. However, counsel for respondents are clear that the matters set forth in this petition warrant vacating the order of reversal herein and substituting an order affirming the decrees below or modifying the same as required by the facts.

In support of their petition, respondents respectfully present the following reasons:

I. No Public Use Whatever Is Shown in 1921 of the Important Element of "Blowing the Powder Produced Out of the Vessel by the Air Blast" as Specified in Claim 2 of the 1,584,150 Patent.

This Honorable Court fell into error, it is believed, in generalizing as to the invalidity of the claims of patent 1,584,150 without differentiating between respective claims, particularly without considering whether all the claims are equally satisfied by petitioner's alleged activities for more than two years before July 14, 1923, the filing date of said patent.

Thus, claim 2 includes as a separate step "causing such blast to **blow the powder** produced **out of the vessel**" (emphasis ours)*. The record does not warrant any holding that petitioner performed a process including the step of blowing the powder out of the vessel more than two years before July 14, 1923.

Petitioner's witness Smith stated (R. I, 466):

> "The air is drawn through the mills in the direction counter to the flow of the lead; that is, the air entered the mill at the trunnion where the Gray Oxide passed out, and left the mill at the trunnion where the lead balls entered."

---

*That this feature of the process is important is clearly evidenced by petitioner's own statements made through its attorney in the file-wrapper during the prosecution of the Hall patent 1,888,823 (PX-18). Thus, in paper No. 12, amendment filed January 20, 1927, page 1, it is stated: "As to claim 5, the Examiner is probably correct in stating that the dust arresters and the dust caught in them are incidental, but the fact that the element 6 called a hopper is a cyclone dust collector in which the bulk of the product, which is the fine part, is blown appears to have been overlooked. Only the coarse part gradually works over the exit end of the mill. . . . The dust blown into and whirling about in 6 falls most of it into the part above 7, which is recovered as the product, and about 10 per cent into the part above 8, which is returned to the mill along with the coarse pieces'. . . as a matter of fact, the fine material, which is the product, is blown out of the mill and the larger pieces roll out of the mill and are returned."

A maximum of thirty-three cubic feet of air per minute was used (DX-43) as contrasted with the three hundred cubic feet per minute subsequently found necessary by petitioner for practical application. Such a gentle flow of air could not possibly blow out heavy lead oxide powders. The air was met by the flow of material moving toward the discharge end as well as the incoming lead balls at the feed end of the drum. This arrangement was continued until at least October, 1923, not only past the two-year critical period but even subsequent to Shimadzu's filing date of July, 1923.

Smith also stated (R. I, 467):

> "In October, 1923, the old Hardinge mill, originally installed at 19th Street, was removed to Crescentville and tests were conducted upon it with the direction of the air flow reversed, so as to coincide with the flow of the product."
>
> "Up to this time, air current through the mills has been in the counter flow direction, as in the original Hardinge mill."

Larger balls were also tried at this time and the witness continued (R. I, 467):

> "Both of these experiments proved successful, so that the eight mills of the larger plant were all arranged to use two-inch balls and to have the air flow in the direction of the product."

Some "dust" may have possibly circulated out with the air passing in the wrong direction and "simply turned loose into the outside air" and wasted. According to petitioner's own witness, no successful means was used to collect this "dust" until December, 1922, or

later, a year and a half too late to constitute a public use against the 1,584,150 patent. Until 1922 all the dust passing out by the air escaped in the building or outside atmosphere and was a total waste. Smith stated (R. I, 461) that petitioner decided to install a dust collector in 1922, and that a Sturtevant dust collector was ordered December, 1922. Hall stated that his "home made" collectors were not satisfactory (R. II, 1024). Hall's oral statement, unsupported by the record, that he used collectors in 1921 is entitled to no credence. The record is entirely lacking in any proof that the powder was moved out of the Hardinge mill by the air prior to at least October, 1923. Therefore claim 2 of patent 1,584,150 could not possibly be invalidated by any two-year public use when, as here, the alleged antecedent process did not conform with or satisfy the claim in question.

Hence, it is respectfully but urgently submitted that this Court's opinion of April 17, 1939, should be modified to affirm unqualifiedly the concurrent holdings of the Courts below that there is no public use bar against claim 2 of the 1,584,150 patent and that claim 2 is valid.

II. The Product and Other Claims of the 1,584,150 Patent Not in Litigation Before This Court Cannot Properly Be Invalidated by the Alleged Prior Use—Lower Courts Concurrently Held That the Evidence Did Not Prove That Petitioner's Product Contained the Elements Recited in the Product Claims.

This Honorable Court fell into error, it is believed, in generalizing as to the validity of the Shimadzu patents without differentiating between the claims now in

suit and the claims not now in suit. On page 11 of this Court's opinion the statement is made:

> "This use, begun more than two years before Shimadzu applied for patents 1,584,150 and 1,896,020, invalidated them."

This statement would appear to hold, for example, that patent No. 1,584,150 is invalid in its entirety.

As appears from page 1 of this Court's opinion, only claims 1 to 4, 6 and 8 to 13 of patent No. 1,584,150 are now involved in the litigation. Of the remaining claims, some were never involved in the litigation and others, the product claims (held valid although not infringed) **were not before this Court.** The Courts below did not hold or intimate that the claims not now before this Court were invalid. These claims cover different features of Shimadzu's invention. There is no foundation upon which to base a holding that any or all of said claims are satisfied by any alleged public use of the subject matter thereof more than two years before Shimadzu's filing date. In fact, the concurrent findings of the Courts below are that the product made by petitioner's Hardinge mill did not satisfy the **product** claims.

Hence the Court's decision should be corrected, it is submitted, to exclude from the scope of its holding of invalidity those claims not now involved in the litigation.

III. Only Claims 10 and 11 of the 1,896,020 Patent Are in Litigation; Decision of the Court Should Not Invalidate Claims 1 to 9, Each Inclusive—Opinion Should Be Corrected to Avoid Any Possible Misunderstanding.

This Honorable Court fell into error, it is believed, in appearing to hold, in the sentence above quoted in Point II, that patent No. 1,896,020 is invalid in its entirety, whereas only claims 10 and 11 were ever involved in this litigation. There is no evidence in the record warranting a conclusion that any of claims 1 to 9 inclusive of this patent are subject to any bar of two years public use, and it would therefore seem clear that the decision should be corrected to preclude an interpretation thereof that claims not in litigation are subject to the Court's ruling on the bar of two years public use.

IV. Claim 2 as Well as Claims 1, 3, 9, 11 and 12 of 1,584,150 Patent Clearly Entitled to the Effective Filing Date as of the 1,584,149 Patent—Hence Alleged Bar of Two Years Public Use Cannot Apply to These Claims—Claim 2 Specifically Applied to the Disclosure of the 1,584,149 Patent.

This Honorable Court fell into error, it is believed, in ruling that patent No. 1,584,150 is invalid upon the ground of public use more than two years before the 1923 filing date thereof without giving to Shimadzu as to common subject matter the benefit of his earlier copending application (1,584,149) which clearly discloses the subject matter of certain of the claims thereof, and constitutes a constructive reduction to practice of such claims, thereby eliminating the alleged public use defense

by giving said claims the filing date of the 1,584,149 patent application.

The application which matured into patent No. 1,584,150 was copending with the application for patent No. 1,584,149, filed January 30, 1922, as to which "the defense of prior public use is not made out" (Opinion p. 11). Claim 2 and others of patent No. 1,584,150, for example, find complete and legally adequate disclosure in Shimadzu's United States application as filed on January 30, 1922. Therefore, under the accepted rule of this Court, Shimadzu for these claims is entitled to said filing date of January 30, 1922, as his effective date from which to reckon the two-year period in determining whether or not the bar of public use exists.

This Court in **Chapman et al. v. Wintroath,** 252 U. S. 126, 137, said:

> "To this we must add that not only have later or divisional applications not been dealt with in a hostile spirit by the courts, but, on the contrary, designed as they are to secure the patent to the first discoverer, they have been favored to the extent that where an invention clearly disclosed in an application, as in this case, is not claimed therein but is subsequently claimed in another application, the original will be deemed a constructive reduction of the invention to practice and the later one will be given the filing date of the earlier, with all of its priority of right. Smith & Griggs Manufacturing Co. v. Sprague, 123 U. S. 249, 250; Von Recklinghausen v. Dempster, 34 App. D. C. 474, 476, 477."

Likewise, in **Smith v. Goodyear Dental Vulcanite Company et al.,** 93 U. S. 486, 501, this Court treated a later (1864) application as "continuous" with respect to an earlier (1855) application to avoid an alleged public use by others than the patentee himself which occurred in 1859 or more than two years prior to the second application but not more than two years prior to the first application.

It is the firmly settled law that as between copending applications a claim in the later-filed case directed to subject matter disclosed in the earlier-filed case is entitled to the benefit of the filing date of the earlier-filed case as against allegations of a two-year public use bar **(Godfrey v. Eames,** 1 Wallace 317.) In **Singer v. Braunsdorf,** 7 Blatchf, 521, Fed. Case No. 12,897, the validity of the claims first presented in the 1853 application over a charge of more than two years public use depended upon the disclosure of the subject matter thereof in an application of 1850. In sustaining the patent maturing from the 1853 application, Judge Blatchford said:

> "The inventions claimed in his patent of 1856 having been shown in his model and drawings filed in December, 1850, he is, in view of the settled law in regard to applications for patents, and in regard to reissues of patents, to be regarded as having applied in December, 1850, for a patent for everything found in such model and drawings, for which he could then have obtained a valid patent."

This rule has been uniformly applied whether the second filed application is a division or a continuation in part

of that which is disclosed in the earlier application, any claim in the later case which is **directed to subject matter common to the two** being given the benefit of the filing date of the earlier case. In **Novadel Process Corp. v. J. P. Meyer & Co.**, 35 F. (2d) 697, C. C. A. 2, the Court said:

> "It was a continuing application, and, in so far as the subject-matter is common to both, it is entitled to priority if the plaintiff desires to assert it as of the filing date of 1916."

To the same effect see **General Electric Co. v. Independent Lamp & Wire Co., Inc.**, 267 F. 824, 836, wherein the Court, speaking per Judge Morris, said:

> "The patents and publications hereinbefore discussed are the only ones of which the effective date is prior to July 2, 1906, the date on which Coolidge filed his first United States patent application for working tungsten. As hereinbefore stated the application on which the patent in suit issued was in part a continuation of the 1906 application. In so far as the earlier application discloses any invention contained in the patent in issue, the patentee is entitled to the benefit of the filing date of the earlier application. Badische Anilin & Soda Fabrik v. Klipstein (C. C.) 125 Fed. 543; Victor Talking Machine Cases (C. C.) 140 Fed. 860; Id., 145 Fed. 350, 76 C. C. A. 180; Id. (C. C.) 177 Fed. 248. This was recognized by the Patent Office."

In **Hayes-Young Tie Plate Co. v. St. Louis Transit Co.**, 137 F. 80, 82, C. C. A., 8, the Court said:

> "In cases in which the first application has not been abandoned, subsequent applications and amendments constitute a continuance of the original proceeding, and the two years' public use or sale which may avoid the patent must be reckoned from the presentation of the first application, *and not from the filing of subsequent applications or amendments. U. S. v. American Bell Telephone Co., 167 U. S. 224, 17 Sup. Ct. 809, 42 L. Ed. 144; Colgate v. Western Union Tel. Co., Fed. Cas. No. 2,995; Miehle v. Read, 96 O. G. 426; Thomson-Houston Electric Co. v. Winchester Avenue R. Co. (C. C.) 71 Fed. 192, 73 O. G. 2155; Godfrey v. Eames, 1 Wall. 317, 17 L. Ed. 684; Smith v. Goodyear Dental Vulcanite Co., 93 U. S. 486, 23 L. Ed. 952; Cain v. Park, 14 App. D. C. 42, 86 O. G. 797, 798; Ex parte Stewart, 4 O. G. 665; Stirling Co. v. St. Louis Brewing Ass'n (C. C.) 79 Fed. 80; Dederick v. Fox (C. C.) 56 Fed. 714, 717; Ligowski Clay-Pigeon Co. v. American Clay-Bird Co. (C. C.) 34 Fed. 328, 333."

The language in a second application need not be identical with that of a first filed application. Even though changes may be made in a description, if the subject matter of a second application is clearly supported by the disclosure of the first application, the second is entitled to the date of the first irrespective of changes.

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*Of course, this would be just as true under R. S. §4886 or R. S. §4887.

Thus, in **Edison v. Allis-Chalmers Co. et al.**, 191 Fed. 837, 843, in a carefully considered case the Court stated:

> "Defendant contends that the divisional application contains subject-matter not disclosed in the original application, and therefore the former cannot be antedated. The descriptive matter, however, in the application upon which the patent was granted, is substantially the same as that contained in the earlier. True, a change was made in the description, but such change in my opinion is not of material importance."

The Court held that the divisional application for the **apparatus** patent was entitled to the filing date of the earlier **process** patent as against an alleged defense of prior public use.

The 1,584,149 patent describes not only the solid drum with the air tube leading there into as illustrated in PX-13, but also in lines 81 to 87 (R. III, p. 1) the other modification in which the drum is perforated with a large number of holes, "whence the powdered product may be blown out to be collected in any suitable chamber." It is also important to note that Shimadzu claimed in the 1,584,149 patent application, as filed, a process involving the specific arrangement of a drum perforated with holes described in detail in the 1,584,150 patent application, (see claim 9 of the 1,584,149 patent application as filed PX-2). From this it is clear that under the wording of either R. S. §4886 or R. S. §4887 Shimadzu unquestionably had made an oath and filed "application" for patent in the United States as of January 30, 1922, for not only the subject matter shown and described in the 1,584,149 pat-

ent, but the modification disclosed and claimed in certain of the claims of the 1,584,150 patent.

Specifically applying claim 2 of 1,584,150 to the process thus disclosed in patent 1,584,149, we find:

Patent 1,584,150 Claim 2—	Patent 1,584,149 Specification—
(a) "A process of manufacturing a fine powder of lead suboxide intermingled with powder of metallic lead" (R. III, p. 4, lines 63-65)	"The present invention relates to a method of manufacturing fine powder of . . . lead" (R. III, p. 1, ls. 1-4) which "easily oxidizes" (R. III, p. 1, ls. 91-92). Note: The experts for both petitioner and respondents are in agreement that air introduced into the mill will oxidize the lead (R. I, 239-259; R. I, 541, 537; R. II, 720; 926-929).
(b) "putting in a rotatable vessel pieces of metallic lead in a dry state" (R. III, p. 4, lines 66-67)	"As the abrasion is going on, the cylinder is replenished with lead ball (s) continuously and at a definite speed at a rate of 100 kilograms an hour." (R. III, p. 1, lines 63-66) and "The cylinder is caused to rotate at a rate of 15-25 times per minute" (R. III, p. 1, lines 69-70).

(c) "introducing into the said vessel while rotating blasts of a gas containing oxygen, such as air" (R. III, p. 4, lines 67-69)	". . . air blast having a pressure of 2.5 pounds per square inch, is sent out of the air-blower" (R. III, p. 1, lines 67-69) which is described as being located "Within this cylinder" (R. III, p. 1, line 54) and "p r o v i d e d with small holes" (R. III, p. 1, line 55).
(d) "causing such blast to blow the powder produced out of the vessel." (R. III, p. 4, lines 69-71)	Very fine powder "is blown out of the cylinder through the discharge orifice by means of the air blast from the said blower, and the lead powder thus blown out is lead into a suitable chamber and collected there." (R. III, p. 1, lines 73-78).

Similar comparisons may also be made with respect to claims 1, 3, 9, 11 and 12 of 1,584,150. Claims 4, 6, 8, 10 and 13 do not find support in patent 1,584,149 because of the specific limitation of maintaining a specific temperature of not less than 60°C. and these claims are therefore here excluded.

It is therefore respectfully submitted that Shimadzu should be accorded the filing date of January 30, 1922, as his effective filing date for each of claims 1, 2, 3, 9, 11 and 12 of 1,584,150, and the said claims accordingly should be held to be valid, inasmuch as this Court has already found that

"The defense of prior public use is not made out against patent 1,584,149, for which application was filed January 30, 1922."

It is therefore respectfully urged that the Court's opinion should be modified to exclude Claim 2 and also Claims 1, 3, 9, 11 and 12 of the 1,584,150 patent from this Court's holding that all of the claims of said patent are invalidated by the alleged public use **since such use was not more than two years prior to the effective filing date to which each of these claims is clearly entitled.** Hence, as to these claims, the concurrent holdings of the Courts below should, it is most respectfully urged, be affirmed without qualification.

V. Claims 10 and 11 of the 1,896,020 Patent Clearly Entitled to the Filing Date of the 1,584,149 Patent. Claim 10 Applied to PX-13, a Drawing Admitted in Evidence by the Courts Below as Representative of the Apparatus Disclosed in the 1,584,149 Patent.

This Honorable Court fell into error, it is believed, in failing to accord to patent 1,896,020, also copending with 1,584,149, the benefit of the filing date of the latter to overcome the alleged bar of two years public use, because the apparatus of claims 10 and 11 of said patent 1,896,020 is clearly disclosed in the 1,584,149 application filed January 30, 1922. The cases and law discussed under point IV are equally applicable here.

A detailed consideration of claims 10 and 11 of the 1,896,020 patent shows clearly that they are supported by the apparatus disclosed in the 1,584,149 patent as a means through which the process there claimed is to be carried out. Respondents introduced as PX-13 (R. I, 165), a diagrammatic sectional elevation of mechanism

described in patent 1,584,149, as to which respondents' witness stated on cross-examination (R. I, 182):

> "This drawing, drawn by an ordinary engineer, deals with the specifications and not with the actual machines I know the actual machines, also I can read specifications, and the way I see this drawing it is a proper representation of what is described in the specification."

Specifically applying claim 10 of 1,896,020 to the apparatus thus disclosed in patent 1,584,149, and illustrated in PX-13, we find:

Patent 1,896,020 Claim 10—	**Patent 1,584,149 Specification**
(a) "Apparatus for the continuous production of a product including litharge in a dry state comprising an apparatus including a vessel in the form of a drum" (R. III, p. 19, lines 114-118).	". . . a circular hollow cylinder made of iron 60 inches in diameter and 60 inches in length (R. III, p. 1, lines 51-53).
(b) "means for feeding pieces of lead into the drum" (R. III, p. 19, lines 117, 118).	". . . Through one end of the cylinder is provided an orifice for feeding it with the material" (R. III, p. 1, lines 55-57) and "As the abrasion is going on the cylinder is replenished with lead ball continuously and at a definite speed at a rate of 100 kilograms an hour" (R. III, p. 1, lines 63-66).
(c) "means for rotating the drum to cause frictional movement between said pieces" (R. III, p. 19, ls. 118-120).	". . . is horizontally and revolubly mounted" (R. III, p. 1, lines 53-54).

(d) "means for supplying under pressure an oxidizing gas to the interior of the drum" (R. III, p. 19, lines 120-122).	"Within this cylinder is provided an air blower with small holes" (R. III, p. 1, lines 54-55). "air blast having a pressure of 2.5 pounds per square inch is sent out of the air blower" (R. III, p. 1, lines 67-69).
(d_1) "to act on said pieces to form a coating of lead suboxide thereon" (R. III, p. 19, lines 122-124).	Note: This function is clearly disclosed in 1,584,-149 and the testimony of the expert witnesses for both petitioner and respondent as to which there is no substantial dispute, to-wit, that when a current of air is introduced on the lead pieces within the drum, lead oxide is formed.
(d_2) "to remove from the pieces the powder formed by the abrading action of the pieces against one another" (R. III, p. 19, lines 124-126).	". . . at the other end an orifice to discharge the product" (R. III, p. 1, ls. 57-58) and "is blown out of the cylinder through the discharge orifice by means of the air blast from said blower" (R. III, p. 1, lines 73-76). Note: See also in this connection the modification referred to in the 1,584,-149 patent, which states "whence the powdered product may be blown out" (R. III, p. 1, lines 85, 86).

(e) "m e a n s associated with said apparatus in which said lead suboxide may be converted into litharge while still in its dry state" (R. III, p. 19, lines 126-129).

Note: It is to be noted that in the 1,896,020 patent this arrangement is referred to (R. III, p. 18, ls. 61-64) as follows:

"With the construction shown, the suboxide powder may be readily converted to litharge before removal from the container b" (which is the collector).

". . . the lead powder thus blown out is lead into a suitable chamber and collected there" (collector) (R. III, p. 1, lines 76-78).

Therefore Shimadzu should be accorded the filing date of January 30, 1922, as his effective filing date for apparatus claims 10 and 11 of patent No. 1,896,020, in which case the subject matter of said claims was not in public use more than two years before that date. Hence, the concurrent findings of the Courts below should be unqualifiedly affirmed.

VI. A Consideration of All the Circumstances Reveals That Petitioner Did Not Plead the Defense of Public Use Based on the 1921-1923 Hardinge Mill Activities; This Court Apparently Overlooked the Total Inadequacy of Petitioner's Proof in Fact, and Under the Authorities to Establish a Public Use, Especially Failing to Note the Clear Line of Distinction Established by the Record Between Petitioner's Experimental and Development Work, Which Was Maintained a Secret, and the Later Operation of Petitioner's Plant.

In holding that the invention of patent 1,584,150 was in public use by petitioner more than two years prior to the filing of the application therefor, this Court, it is believed, overlooked the following facts:

1. The statutory bar of "public use" was not pleaded by petitioner and therefore was not in issue;

2. The record includes three statements made under oath by the person best qualified to know the real character of petitioner's early activities, namely petitioner's engineer, Hall, to the effect that such activities did not constitute a public use;

3. The burden of proving beyond a reasonable doubt that petitioner's activities with its first Hardinge mill, 1921 to 1923, constitute such a public use as under the decisions of this Court and the Federal Courts would bar the process claims of patent 1,584,150 was on petitioner;

4. There was no burden of proof on respondents to prove that no statutory bar of public use existed against the claims of this patent;

5. All of the relevant testimony and exhibits clearly show that petitioner's use was secret and experimental although on a commercial sized apparatus. The record is completely barren of countervailing proofs.

Further, respondents respectfully but earnestly submit that in order to arrive at the conclusion that patent 1,584,150 is invalid because of petitioner's public use of the invention thereof, it was necessary for this Honorable Court to make three new findings of fact unsupported by, and inconsistent with, the record, as follows:

(a) That petitioner's operation of the Hardinge mill was continuous from June, 1921, on;

(b) That the material manufactured by petitioner in its Hardinge mill from June, 1921, on was used in the manufacture of storage batteries which were "sold in quantity"; and

(c) That petitioner's use was not secret.

These points will now be discussed in the order set forth above:

(1) Considering first the general allegations and denials of the pleadings, respondents respectfully submit that this Court's suggestion that respondents' pleadings aided or contributed in any way to placing in issue properly the particular public use defense now relied upon by petitioner, and hence that respondents are to that extent responsible for raising this issue, is in error and unsupported by the record.

A careful analysis of the bill of complaint discloses that respondents pleaded, with respect to each of the inventions of the patents in suit, that the same had not been in public use for more than two years before the applications therefor were filed (see paragraphs 5, 7 and 15 of the Bill of Complaint, R I, 8, 9, 14). The petitioner answered each of the foregoing allegations by denial based on lack of information, positively asserting

that "it was not informed" (save by the bill of complaint) as to the truth of respondents' allegations—including those relating to the two-year public use bar (see paragraphs 5, 6 and 10 of petitioner's Answer, R I, 28, 30). By this language the denial in the answer is limited so as to exclude any alleged prior public use of which petitioner was informed at the time of making said answer.

Stated otherwise, respondents alleged, in effect, that there was no statutory bar of two-year public use. In its answer to these particular paragraphs petitioner in effect denied the truth of such allegations on lack of information, stating that it "is not informed." Obviously, it must have been informed of all activities in its own plant. Hence, by the very wording chosen by petitioner itself, the particular alleged prior use now relied upon was **excluded** by its own pleadings.

Moreover, considering now the alleged affirmative allegations with respect to the pleading of "public use," it is also respectfully urged that petitioner has failed properly and unequivocally to set up the defense of "public use" in contradistinction to prior knowledge or use to show prior inventorship notwithstanding that in R. S. §4886 and §4920 "public use" is distinctly specified as a different and separate defense from that of prior knowledge and use.

Pertinent paragraphs of petitioner's answer are 18; 19 and 26 (R. I, 32, 33, 35) which allege as follows:

> "18. Answering Section 24 of the bill, defendant denies all acts of infringement and denies the appropriation and use of any informa-

tion, data or disclosure of Shimadzu's alleged inventions, and alleges that it was successfully making, using and selling its product long before it ever heard of Shimadzu or of his alleged inventions and patents.

"19. Answering Section 25 of the bill, defendant denies all acts of infringement with which it is charged, but admits that it is practicing the process and making a product described and claimed in U. S. letters patent to Hall, No. 1,888,823, dated November 22, 1932, and which it used commercially and successfully long prior to any date of invention established by Shimadzu in said interference proceedings."

"26. . . . defendant avers that the claims of said letters patent are invalid and void because the subject matter thereof was, prior to the alleged invention thereof by Shimadzu, and for more than two years prior to his application dates, **known to and used by** the defendant at Philadelphia, Pennsylvania, and by the Willard Storage Battery Company at Cleveland, Ohio."

Paragraphs 18 and 19 of the answer are insufficient in law to plead a statutory public use bar, due to the omission of the necessary allegation that the use was "public" for more than two years prior to the filing of the applications. In **Agawam Co. v. Jordan,** 74 U. S. 583, an allegation that the invention had been in public use **long prior to the filing of the application** was held insufficient to raise this defense. See also **Bates v. Coe,** 98, U. S. 31, 37, 45-47. Moreover, the allegations of paragraph 19 of the answer referring to commercial and successful use of the Hall process and apparatus appear in the admission clause and not in the

denial part so that no issue whatever could be raised by such allegations.

This leaves only the allegations of paragraph 26 of the answer for consideration. The issue is whether this paragraph properly pleads a prior "public use" under R. S. §4886 and §4920. Clearly, this paragraph of the answer pleads defense of **prior knowledge and use,** which properly is directed against the patentee's right to the claim of **original and first inventor.** Prior knowledge or use **before** the patentee's **date of invention or discovery** nullifies the patent. It may be **more or less** than two years prior to the filing of the application for patent but if prior to the patentee's date of invention or discovery, the patent is of no validity.

The defense of "public use" is not addressed to that issue but is in the nature of a plea in confession and avoidance. The use must be **public** and must have been so used for more than two years prior to the filing of the application for patent, irrespective of whether such public use was **before or after** the patentee's date of invention or discovery. The two defenses are therefore in the express language of the patent statutes and in logic separate and distinct. Under R. S. 4920, prior knowledge and use is a defense under paragraph 4th, whereas public use is a defense under paragraph 5th.

The only language in paragraph 26 of the answer that lends color to petitioner's claim (which respondents do not admit) that a public use bar was pleaded are the words "for more than two years prior to his application dates **known to and used by** the defendant at Philadelphia, Pennsylvania . . ."

It is well established that the fundamental purpose of R. S. §4920 in requiring special notice of this defense is to prevent surprise and to permit a patentee to be reasonably apprised of issues which confront him and to defend the same. The question arises whether the allegation above quoted properly put in issue this defense and whether it constituted fair, equitable and reasonable notice thereof to respondents.

Respondents most earnestly urge that paragraph 26 of the answer pleaded, when fairly construed, the defense of prior knowledge and use and not public use. The authorities are unanimous that "public use" must be specifically, distinctly and separately pleaded as an affirmative defense, and a strict compliance with statutory requirements has been held essential. The language used by petitioner admittedly is ambiguous, if not astutely employed.

Respondents are not attempting to lay great stress on mere technical or formal defects in the pleadings. They are in fact in a far worse position than a plaintiff who at the hearing has been taken by surprise by the defense of public use. The injustice of permitting this procedure has been appreciated and remedied by R. S. §4920, which requires that thirty days' notice before the hearing be given if the defense is to be relied upon. Not only was no notice given but the defense was not urged until after the trial and hearing had been completed.

That petitioner intended not to set up a public use defense by the pleadings, based on its Hardinge mill activities, or introduce proofs of the same at the trial was fully and emphatically confirmed by statements of counsel for petitioner which clearly excluded the Hardinge

mill activities as a "public" use. At the hearing (R. 742, 743, Original Transcript), counsel for respondents pointed out to the Court that in Hall's original application and during the interference Hall had sworn that these very activities now set up were "not in public use for more than two years prior to his filing date and he filed in 1924." In reply thereto counsel for petitioner stated "That is the Hardinge mill." Hence, it will be seen that counsel for petitioner definitely indicated that the oath filed by Hall to the effect that his invention was not in public use more than two years prior to his filing date in 1924 was correct. Respondents unhesitatingly state that none of the proofs introduced by them and none of their cross-examination of petitioner's witnesses was directed to the issue of public use because none was in issue.

Further petitioner instituted and prosecuted the Hall v. Shimadzu interference (R. I, 69). It and Hall maintained throughout that Hall was entitled to the monopoly of the 1,584,150 patent. They lost, but as a result, Hall amended his claims and obtained two patents covering the apparatus and process. This they were able to do because of Hall's oath that no public use existed for more than two years prior to March, 1924. Had petitioner and Hall revealed or contended that the 1921 activities were public, they would never have been able to maintain the interference or to obtain the patents they now possess.

Knowing these circumstances, it was unimaginable that petitioner would contend that the very activities forming the basis of its interference and the Hall pat-

ents constituted a public use. Such a position would have been untenable.

No responsible company, such as petitioner, could or would care to take such an equivocal position. With these facts in mind, a careful review of the pleadings will reveal that petitioner could not and did not plead public use and that it was most natural and reasonable for respondents to assume from the particular phraseology of the answer that public use was not pleaded. Consequently, this Court's opinion that this issue was before the parties is not only at variance with the actual facts, but respondents have not had its day in court on this question.

If, however, the Court is unable to agree with respondents, then in view of the ambiguity of findings below and in order to prevent a gross miscarriage of justice, the cause should be remanded to the District Court for a specific finding on this issue.

It is therefore respectfully submitted that it is grossly unjust and inequitable to permit the petitioner to now rely on the defense of public use, particularly in view of the fact that the public use relied on is petitioner's own public use, whereas in its answer petitioner alleged that it had no knowledge of any public use. As of that time all of the information concerning petitioner's activities was wholly within petitioner's knowledge.

(2) The development of petitioner's process was entirely in the hands of its engineer, Hall, who was employed by petitioner for this specific purpose. On March 29, 1924, Hall filed two applications for letters patent, one entitled "Leaden powder and method of making the

same," Serial No. 702,889, and the other entitled "Apparatus for Making Leaden Powder," Serial No. 702,890. These applications matured as patents 1,888,823 and 1,675,345, respectively. In the oath accompanying application 702,889, Hall stated that the invention disclosed therein was not "in public use or on sale in the United States for more than two years prior to this application." The same statement under oath appears in application Serial No. 702,890. Again, on March 26, 1927, Hall executed under oath a preliminary statement which was subsequently filed in the Hall v. Shimadzu Interference which involved Shimadzu's patent 1,584,150 "that the invention was not in public use or on sale within two years prior to filing the original application." Thus we have three statements all made under oath by the engineer who developed petitioner's process, which statements were made long prior to the commencement of this suit, to the effect that whatever Hall's activities prior to March 29, 1922, may have been, they did not constitute "a public use". These oaths alone conclusively rebut any charge that the petitioner's activities as early as June, 1921, constituted a public use.

Both petitioner and Hall, "in whose shoes defendant (Petitioner) stands" (R. I, 69, 106), are clearly estopped from relying on the defense of public use. Shimadzu, relying on Hall's representation that no statutory bar of public use existed to bar the grant of a valid patent, engaged in the interference which was provoked by Hall in 1927, and at great expense litigated the same to a final conclusion before the Court of Customs and Patent Appeals in 1932. The testimony offered by, and on be-

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half of Hall having clearly shown infringement by petitioner of Shimadzu's patent, this suit was instituted to enjoin the same and to recover profits and damages. Thus, for twelve years Shimadzu has been denied full enjoyment of his patent rights and has been put to many thousands of dollars of expense. If Hall's representation in respect of public use was in fact a misrepresentation, all of the elements of an estoppel are present. Shimadzu relied upon the same and in so doing suffered great damage. Again, Shimadzu's licensees, all large American manufacturers, have suffered irreparable damage over a period of many years by reason of their reliance on the truth of the allegations of Hall and petitioner. Clearly, petitioner is now estopped from denying the truth of the allegations of Hall's oaths.

(3). The burden of proving that the activities with the Hardinge mill in June, 1921, constitute a public use was on petitioner. **Eibel Process Co. v. Minneapolis & Ontario Paper Co.**, 261 U. S. 45. This burden petitioner must sustain and prove beyond a reasonable doubt. The defense cannot be established by dubious proofs. This rule has been so often and authoritatively enunciated by this and other Federal Courts that the citation of cases is deemed unnecessary.

(4) It follows as an inevitable corollary that there was no burden on respondents to disprove the existence of the statutory bar of public use. They could properly rely upon the presumptions arising from grant of the patents. Unless and until this defense is properly placed in issue and prima facie established, no burden whatever existed on respondents to come forward with countervailing proofs

(5) This brings up the question: Do the proofs in the record establish a statutory bar of public use? Respondents answer that they do not, and respectfully submit that this Court must have overlooked the insufficiencies of the record, which clearly show the failure of petitioner to establish the public use relied upon.

This Court has consistently held in **Langnes v. Green**, 282 U. S. 531, 583; **Stelos Co. v. Hosiery Motor-Mend Corp.**, 295 U. S. 237; **Commission v. Havemeyer**, 296 U. S. 506, 509; **Helvering v. Gowran**, 302 U. S. 238, 245; **Helvering v. Pfeiffer**, 302 U. S. 247, 252, 253, that even though no cross-petition was filed, respondents are not estopped from urging any reasons of record in support of the decrees entered below. It is believed this Court overlooked this rule of law which is especially applicable here where:

1. Petitioner applied to this Court for writ of certiorari as to those parts of the decrees below entirely in respondents' favor; and

2. Respondents could not have properly petitioned this Court for a writ of certiorari as to those parts of the decrees below in their favor.

The record is completely barren of a single bit of oral testimony or a single exhibit which shows or even tends to show:

(a) That petitioner's operation of the Hardinge mill for a long period of time after June, 1921, was continuous;

(b) That a single ounce of powder produced by petitioner in its Hardinge mill during the year 1921 was used in the manufacture

of storage batteries or any other product "which have been sold in quantity" or in any other manner;

(c) That the location of the Hardinge mill in the petitioner's plant during 1921 was such that any employees other than those directly engaged in the operation of the mill had access to or were ever permitted to see the mill in operation or any other time;

(d) That those few employees directly engaged in the operation of the mill were not pledged to secrecy.

In construing the language of the District Court "commercial production" as tantamount to a holding of "public use"; this Court made findings of fact **de novo** in that it decided affirmatively the fact issues listed above. In so doing, this Court went much farther than even petitioner urged is warranted by the record. It is significant to note that in its briefs filed in this Court and in its oral argument before this Court, petitioner did not contend that its activities at any time during the year 1921 constituted a public use. Petitioner based its prayer for a holding of public use entirely on the language which appears in the opinion of the District Court of "commercial production" plus the fact that respondents produced as one of their witnesses, one (not several as stated in this Court's opinion) former employee of petitioner who did not enter the employ of petitioner until more than two years after June, 1921, and who therefore could have had no personal knowledge concerning petitioner's 1921 activities. The only record citation made by petitioner with respect to any facts bearing on the issue of public use in any of its briefs or

during its oral argument before this Court is a passing reference appearing on page 16 of petitioner's reply brief to substantiate the fact that some sort of powder was made during 1921 from which battery plates were made. Even a casual checking of the record citation (R. I, 465) quickly reveals that the plates referred to were manufactured for test purposes only.

That the operation of the Hardinge mill by petitioner during the entire year 1921 was intermittent and at extremely infrequent intervals and only for the purpose of producing powder to carry out the experimentation called for by defendant's exhibit 68 is clearly shown by the record. The tabulation of the data contained in defendant's exhibits 60 through 65 reveals that during the entire latter half of the year 1921 the dates and number of hours that the mill was operated are as follows:

Def. Ex. 60	June 14, 1921	16 hours
Def. Ex. 62	August 19, 1921 August 20, 1921	22 hours
Def. Ex. 61	Sept. 26, 1921 Sept. 27, 1921	45 hours
Def. Ex. 64	Oct. 6, 1921	5 hours
Def. Ex. 65	Nov. 18, 1921	1¾ hours
Def. Ex. 63	Dec. 6, 1921	11 hours
	Total	100¾ hours

Thus, it will be seen that the mill was operated on but six occasions from June 14, 1921, to December 6, 1921, for a total of 100¾ hours. This circumstance alone clearly demonstrates that the operation was not "the ordinary use of a machine for the practice of a process in a factory in the usual course of producing articles for commercial purposes."

Petitioner in its Bill of Particulars (R. I, 120) confirmed the fact that the log sheets in evidence represent the only occasions upon which the mill was operated, stating that among other things, it intended to rely on "log sheets beginning February 11, 1921, **for every day the mill was run**" prior to July 14, 1921, to establish the defense of prior knowledge and/or use.

At no time during the entire suit has petitioner contended that any of the powder produced by it in its Hardinge mill during the year 1921 was used in the manufacture of plates for storage batteries which were sold. Testimony relating to the disposition of the powder was given orally by petitioner's witness Smith as follows (R. I, 465):

> **"During all the year of 1921, and more especially during the latter part of the year, the lead dust from the Hardinge mill had been constantly used to make battery plates, and these battery plates had been put through formation and subjected to many tests. As a result of this testing of various lots of Gray Oxide, Hall, by the end of 1921, had confirmed the general conclusion of Kershaw that, approximately seventy per cent litharge content was the optimum composition, and accordingly adopted sixty-seventy per cent as his limits; later further narrowed down to sixty-five, seventy per cent. The figure of sixty-five, seventy per cent PbO content has remained the standard up to the present time.**
>
> **"As already noted, as soon as the Hardinge mill started to produce lead dust in quantity, this material was made into plates, which were then tested by the laboratories. Exhibit 68, headed Special Process Number 5065, was issued**

by the Department of Development and Design, on April 22, 1921, instructing the superintendent's department to make certain plates with lead dust, under the supervision of Kershaw. This Special Process Number 5065 was subsequently extended by the issuance of forty-two other sheets calling for additional plates, the last sheet, dated October 26, 1922. Upwards of 3,700 motive power plates, and 55,000 starting plates were made under this Special Process Number 5065, and the tests of these plates satisfied The E. S. B. Company that the material made by Hall—slight error, typographical error there—that the material made by Hall in the Hardinge mill was substantially like that produced by Kershaw in the German type of mill, and that it was perfectly satisfactory to use.

"By the latter part of 1922, all the product which could be produced by the Hardinge mill (now known as Gray Oxide) was used in standard plate production, but the quantity available fell far short of the total demand."

This is the testimony upon which petitioner is relying to establish an operation so commercial in nature as inevitably to constitute a public use. The testimony clearly shows nothing but experimental and test operation until the latter part of 1922. Examining petitioner's Exhibit 68, which is entitled "Experimental Shop Process," it is to be noted that Mr. Howard was instructed to deliver to the storeroom the positive plates which were to be pasted on three consecutive days with powder received from the Hardinge mill. The last paragraph on this exhibit states:

"Careful note to be made of condition of plates as to scaling, etc., and all plates delivered to Storeroom to be held as special and delivered to Laboratory as called for."

Moreover, attention is specifically called to the fact that directions were included to "Please allow Mr. Kershaw to give this personal supervision." It is significant to note that although Mr. Kershaw was called to testify, he was not asked any question with respect to these alleged tests, the legal inference clearly being that if he had been so examined, his testimony would have been unfavorable to petitioner. Moreover, it is important to note that the procedure under the "Experimental Shop Process" of exhibit 68 was continued as Smith supra states until October, 1922, well beyond the critical period. Had any of the material produced during this period been sold, petitioner would have been able to have established that fact by evidence as elaborate as that which it produced to establish its single sale of batteries manufactured from material produced by it in 1916 or 1917 by its Tudor mill. It is obvious that the fact finding of this Court that petitioner employed the alleged infringing machine and process for the "production of lead oxide powder used in the manufacture of plates for storage batteries which have been sold in quantity" since June, 1921, is clearly in error and totally unsupported by the record. In fact, the record contains negative proof that none of the powder produced in 1921 was used for commercial purposes. Petitioner was called upon to give figures showing the percentage which the material manufactured in the Hardinge mill and used in production bore to the total amount of material used by petitioner

in its manufacture of storage batteries. Figures were given for each year commencing with 1922 through 1934. **No figure was given for the year 1921.** As to the figures given for other years, petitioner merely stated that the quantity of oxide manufactured in its Hardinge mill equalled a certain percentage of the quantity of oxide which it used in commercial manufacture, but failed to state how much, if any, of the material manufactured in the Hardinge mill was used in commercial manufacture prior to 1923.

Petitioner throughout the trial, especially by its counsel's remarks quoted supra from the original transcript, definitely led respondents to believe that the Hardinge mill activities were not advanced as a "public" use; each time petitioner subsequently advanced a contrary contention, respondents have successfully sustained the proposition that a public use based on these activities had not been originally properly pleaded. Hence, in view of the fact that petitioner's actions resulted in preventing respondents from "having their day in Court" on this issue respondents have now undertaken an investigation and examined two witnesses, one of whom was in the employ of petitioner until shortly before the trial and the other of whom respondents learned about from the former. The affidavits of these two witnesses are attached to this petition in order to enable the Court to learn the true facts with reference to (1) the lack of publicity of the alleged use, and (2) the lack of sale of the product during the year 1921. Hence, respondents respectfully pray that this Court consider these affidavits in connection with the record.

No testimony was taken bearing on the question of secrecy of operation. Now that the issue has been raised, respondents have ascertained from the annexed Affidavits of Clarence J. Treston and John J. Deegan that "efforts were made to conceal" (Opinion, pg. 11) the experiments. A consideration of these affidavits will show this Court that the utmost secrecy surrounded the experiments conducted with the Hardinge mill during the critical period as these affiants, although employees in the chemical laboratory, were instructed not to enter the building where Hall was conducting the experiments and the matter was to be treated as a "secret."

The defense of public use must be proven beyond a reasonable doubt and the finding of public use based on inference is, we submit, clearly in error. It is too well settled for argument that he who has the burden of proof must sustain the same by adequate evidence. If he fails to do so, he must inevitably lose. Where no evidence is directed to the issue, a holding that the burden has been sustained is clearly unwarranted.

Again, there is not a word of testimony in the record to indicate whether or not those few employees directly engaged in operating the Hardinge mill during 1921 were pledged to secrecy. Here again is an additional fact, proof of which should properly have been offered by petitioner if it hoped to sustain its burden of proving public use beyond a reasonable doubt. Failure of petitioner to introduce such proofs certainly should not give rise to the inference favorable to petitioner that such employees were not enjoined to secrecy.

While the Court below stated that "commercial production by the Hardinge mill with its forced air draft undoubtedly involved the use of plaintiff's patent, and June, 1921, may be fixed as the date when that began," respondents submit that this finding is in error if it is intended as meaning that the petitioner from June, 1921, on was operating its Hardinge mill day in and day out to produce large and regular quantities of material of sufficiently uniform character to be used in the fabrication of storage battery plates and was so used in the plates so fabricated and sold in the ordinary channels of trade. Respondents further and most earnestly submit that this finding cannot be so construed in view of the total absence from the record of any facts which would offer the slightest support or which would even lend color to such an interpretation.

The District Court obviously did not make a specific finding of public use. Nowhere in the findings of fact does the word "public" appear. This Court has seen fit to construe the holding of "commercial production" as tantamount to a holding of "public use". If there be uncertainty as to the exact meaning of the language employed by the District Court, such uncertainty should be resolved by reference to the record and the language should be given only such meaning as finds support in the record. This Court has apparently failed to follow this procedure but, on the contrary, has made an inference as to the character of petitioner's 1921 Hardinge mill operation from which inference it has made a second inference; to-wit, that the inferred character of operation constituted in fact a public use.

The District Court clearly indicated its meaning of the term "commercial production" as used by it in contradistinction to the "public" phase of such use where the Court stated (R. II, 1164):

> "* * * some process by which the right kind of powder could be produced in trifling amounts was of very little value to anyone. The industry was looking for a way to make large quantities cheaply, and an invention which fell short of accomplishing that result would have been of academic interest only."

Again (R. II, 1176), the Court pointed out by contrast that the Tudor mill did not "meet the requirements of a commercially useful process." Hence the Court's use of the word "commercial" is consistent in distinguishing between an operation conducted on a commercial scale in order to determine its economic value from one conducted on a laboratory scale which might prove nothing. If so much weight be accorded to the lower Court's use of the term "commercial production" in its first decision, in all fairness to respondents, it seems evident that like weight should be given to that Court's term "reduction to practice" (which eliminates any thought of "public" use) in characterizing the identical activities as appears in the District Court's decision on rehearing published 36 U. S. P. Q. 25. There is no connotation in the Court's use of "commercial" indicating an intent to characterize the experimental work as a "public use". The record abundantly establishes that not only was the use of the process in June, 1921, entirely experimental, but the experimental character continued for many months thereafter during which numerous changes were made while

Hall was searching for a satisfactory and economically operative process.

Where such experimentation has characterized the use, the courts have uniformly held that such use did not raise the bar of public use referred to in R. S. 4886, even though there were incidents of profit accompanying the use. In the present case, however, the record establishes that petitioner's use in June, 1921, of its process was not even for profit. Therefore, the facts bring the June, 1921, experimental use well within the rulings of this and other courts as to what is no more than an approach toward a yet unaccomplished end. Not until the experimentation has reached its goal does the two years begin to run, and in June, 1921, Hall was far from having perfected a satisfactory process. Thus, defendant's own exhibits, DX-61, 62, 63, 64 and 65 show that in August, September, October, November and December, 1921, Hall was still experimenting with variations in load, speed of revolutions, degree of oxidation and quantity of air employed, the tests in October, November and December materially reducing the amount of air, and increasing the peripheral speed to obtain **an increased production** whereas the final commercial success required **just the opposite,** i. e., **an enormous increase in the amount of air and a reduction in the peripheral speed.** Prior to the conclusion of his experiments, Hall's process certainly was not in public use.

It will be noted from the file wrapper of the Hall patent No. 1,888,823 (Pl. Ex. 18) that Hall pointed out with great particularity the fact that the usable finished product which came from his mill was blown from the

mill by the current of air passing therethrough and that such material as spilled out mechanically through the discharge trunnion was of too coarse a nature to be used and was returned to the mill for further attrition. But, not until 1923 did Hall reverse the direction of travel of the air passing through the mill so that it could remove any substantial quantity of suitable powder (R. I, 466).

The attention of this Court is respectfully invited to respondents' discussions presented in its main brief and in its reply brief filed with this Court under the caption "Point III," in which a detailed showing is made of the manner in which petitioner varied the operating conditions throughout the entire year of 1921, conditions which petitioner's own witnesses termed "vital". In addition, Hall stated (R. II, 1041):

> "We kept on getting larger fans until we could get the amount of air through the mill that we wanted.
>
> "Q. And you desired to increase the amount of air, is that right?
>
> "A. Three hundred cubic feet is what we wanted for this particular product. At one time, at least, during the time of the filing of the application we were using one hundred and fifty cubic feet, we were getting a small amount of product out."

Hence, Hall clearly indicates that they wanted a large amount of air (three hundred cubic feet). However, the record is entirely silent as to when they changed from the fans of insignificant size used in 1921 (maximum capacity 33 cubic feet per minute) to the relatively enormous fans delivering from 500 to 1000% more air. It is

respectfully submitted that those facts when considered with the above present a clear and convincing picture of nothing more than a prolonged period of experimental operation during which time petitioner was concerned with a determination first, of whether or not it could make powder which indicated suitability for storage battery purposes and second, whether or not storage batteries of acceptable quality could be manufactured from the powder. As is well known in the storage battery industry, the second class of experimentation alone requires an extremely long period of time, as the only manner in which storage batteries can be satisfactorily tested for life is to submit them to life tests in the field. The average life of the ordinary automotive type storage battery is approximately eighteen months. Certainly this petitioner, a large manufacturer of storage batteries, was not going to jeopardize its good will by selling batteries manufactured from its Hardinge mill oxide until it had run a sufficient number of tests over a sufficiently long period of time to satisfy itself that the batteries so manufactured would not be inferior to petitioner's standard production batteries made from purchased oxides.

That an experimental use is not a public use under the statute is recognized by this Court in reference to **Elizabeth v. Pavement Co.,** 97 U. S. 126. The foregoing facts bring the instant case well within the doctrine of that case. See also **Beadle v. Bennett,** 122 U. S. 71, 76, 77.

Unlike the facts set forth in **Smith and Gregg Mfg. Co. v. Sprague,** 123 U. S. 249, 265, the facts of the instant case do show that Hall after June, 1921, continued to

vary his process so that "more than one mode of overcoming the difficulties experienced was suggested and tried." Unlike the facts set forth in **Root v. Third Ave. Railroad Co.**, 146 U. S. 210, 225, Hall was continuously making "experiments with a view to alterations" and "keeping the invention under his own control." Unlike the facts in **Manning v. Cape Isinglass & Glue Co.**, 108 U. S. 462, 465, Hall was during this time repeatedly making material changes in the process.

The doctrine of **Elizabeth v. Pavement Co.**, 97 U. S. 126, has been applied by the Federal Courts in many cases where, as here, experimentation was carried on in good faith in an effort to complete and perfect the invention, even though th experiments were performed under conditions in which the public had access thereto (**Harmon v. Struthers**, 57 F. 637, 641, C. C. W. D. Pa.; **Pacific Cable Ry. Co. v. Butte City St. Ry. Co.**, 55 F. 760, 765, C. C. Mont.; **Westinghouse Electric Manufacturing Co. v. Saranac Lake Electric L. Co.**, 108 F. 221, 228, C. C. W. D. N. Y.; **Eclipse Machine Co. v. Harley Davidson Motor Co.**, 252 F. 805. 811, C. C. A. 3; **Los Angeles Lime Co. v. Nye**, 270 F. 155, 162, C. C. A. 9; **Austin Machinery Co. v. Buckeye Traction Ditcher Co.**, 13 F. (2d) 697, 698, C. C. A. 6; **Kearner Incinerator Co. v. Townsend Estates**, 27 F. (2d) 599, 604 (affirmed C. C. A. 6, 27 F (2d) 606); **Reo Motor Car Co. v. Gear Grinding Machine Co.**, 42 F. (2d) 965, 968, C. C. A. 6; **Cleveland Trust Co. v. Schriber-Schroth Co.**, 92 F. (2d) 330, 336, C. C. A. 6 (reversed on other grounds by this Court, 305 U. S. 47). In all of the foregoing cases the rule is recognized that, to use the language of the Court in **Reo Motor Car Co. v. Gear Grinding Machine Co.**, supra,

> ". . . So long as the use by the inventor, or even sales to the public can fairly be considered experimental and collateral to the development of the invention in its complete form, the bar does not begin to run."

The foregoing analysis of the record evidence clearly establishes that Hall was experimenting "in good faith, in testing (the) operation" (**Elizabeth v. Pavement Co.**, supra), of the process from June, 1921, until 1922 or 1923 attempting to develop his invention into its completed form. Hall obtained two patents in the United States based on his oath that these identical activities were **not a public use** relying undoubtedly on the rule of law that he was experimenting with the machine and engaged "in good faith, in testing its operation." Hence, neither Hall nor his privy, petitioner, should now be heard to say that Hall was not then proceeding "in good faith in testing" the invention, but should be bound by these affirmations. Moreover, the record clearly confirms the truth of Hall's original oaths and shows that the use of the Hardinge mill in June, 1921, was a mere stage in this developmental work. It was followed as before pointed out by numerous alterations in the procedure in his searching about for a successful solution of the problems with which he was confronted. Even if during this experimental period Hall or his assignee had derived profit from the experimental use of the process referred to, the use would not have been outside of the rule of Elizabeth v. Pavement Co. where, as here, the experimentation was the dominating consideration (cf. **Wendell v. American Laundry Ma-**

chine Co., 239 F. 555, 558, affirmed C. C. A. 3, 248 F. 698). But the record additionally establishes as above pointed out that there was no profit derived from the use of the invention, that the product produced by the use of the process was not used commercially, and that all of the powder made during Hall's experimental period was employed in plates delivered to the laboratory for the purpose of tests.

WHEREFORE, respondents respectfully pray:

(1) That the corrections requested in Points I to V, inclusive, be allowed and appropriate modifications of this Court's judgment be entered accordingly.

(2) In connection with Point VI, respondents respectfully pray—

(a) That this Court grant a re-hearing of the question of public use; or

(b) That this Court reconsider and vacate its judgment based on the public use issue and unqualifiedly affirm the concurrent findings of the Courts below that the 1,584,150 and 1,896,020 patents are valid; or

(c) That this Court modify its judgment, vacate the order of reversal and remand the case to the District Court for further proceedings in connection with the public use issue, with authority to take further testimony if, in its discretion, such action is necessary, make findings on the fact issue of public use and enter its decrees accordingly.

(3) That this Court stay the issuance of its mandate herein until a disposition of the matters prayed for in this petition has been finally made by this Court.

Respectfully submitted,

GENZO SHIMADZU,
NORTHEASTERN ENGINEERING CORPORATION.

By EDMUND B. WHITCOMB,
GEO. WHITEFIELD BETTS, JR.,
JOSEPH W. HENDERSON,
Counsel for Respondents.

GEORGE H. SOUTHER,
GEORGE YAMAOKA,
Of Counsel.

Dated: Toledo, Ohio, May 11, 1939

CERTIFICATE

I hereby certify that I am a member of the Bar of the Supreme Court of the United States; that I am counsel for Genzo Shimadzu and Northeastern Engineering Corporation, respondents in the above entitled cause; that the foregoing petition for rehearing has been prepared in accordance with the request of the respondents; and that it is presented in good faith in the belief that it should be granted and not for delay.

EDMUND B. WHITCOMB.

AFFIDAVIT OF CLARENCE J. TRESTON

STATE OF OHIO,
COUNTY OF LUCAS } ss:

CLARENCE J. TRESTON, being first duly sworn, deposes and says:

1. He is 51 years of age, a chemist by occupation, having attended Temple University in Philadelphia taking the chemical course, and ever since that time has been engaged in chemical or industrial chemical work.

2. In May, 1920, he entered the employ of petitioner, The Electric Storage Battery Company of Philadelphia, Pennsylvania, manufacturers of storage batteries, and, excepting for approximately seven months in 1927, was in its employ until May, 1935, engaged as an analytical chemist and in process control work and employed in the chemical department under the chief chemist, George M. Howard, and the immediate supervision of one W. Y. Kelly, his assistant. Deponent's duties during this time included analyzing various lead compounds, such as lead oxide, litharge, red lead and many other substances used in the manufacture of storage batteries.

3. Deponent became acquainted with Clarence A. Hall, in the year 1920 and throughout the years 1921 and 1922 and part of 1923, tested many samples of material which were delivered to the chemical laboratory in the company's main building on the southeast corner of Allegheny Avenue and Nineteenth Street, Philadelphia, by operators working under said Hall and operating what was known as "the experimental mill" located in a sep-

arate building a half-block away from Allegheny Avenue on Nineteenth Street and not physically connected with any other buildings of the petitioner's plant. These experiments related to a process for making lead oxides of the general type to be employed in the manufacture of storage batteries, although at the time The Electric Storage Battery Company was purchasing large amounts of litharge and red lead for this purpose.

4. All through the years 1921, 1922 and part of 1923 deponent was never permitted to enter the separate building in which the experimental mill was located and to his knowledge no other employees of the chemical laboratory were permitted to enter same. Deponent further states that during that period he knew that there were definite orders to keep away from this building, and the understanding was prevalent among all employees of The Electric Storage Battery Company that the matter of this mill was to be treated as a secret. All the mill operators with whom deponent came in contact as they delivered samples from the experimental mill to the chemical laboratory where deponent made the analyses referred to maintained silence (with the single exception with reference to mechanical difficulties hereinafter referred to) with respect to the operations going on, and the entire efforts on the part of Hall during all of 1921 and 1922 were regarded at the plant as a secret, any facts of which were not to be divulged to any one and his co-employees were instructed not to discuss the matter.

5. When these samples were delivered to the laboratory from time to time on several occasions during the years 1921 and 1922, the operator stated that he would

not have any more samples to deliver for a period of time in the future in view of the fact that the mill was shut down because of various troubles experienced in the operation of the same. Contrasted with deponent's subsequent work in testing similar samples from the Crescentville plant to all parts of which deponent had free access, the samples deponent received from "the experimental mill" in the separate outside building on Nineteenth Street were received only extremely intermittently and not continuously. At no time in the year 1921 were the samples from this experimental mill delivered to the chemical labroatory regularly day by day, although deponent recalls that in 1922 samples came more frequently to the laboratory.

6. Deponent was transferred in March, 1923, to the chemical laboratory at the Crescentville plant of The Electric Storage Battery Company, located at Rising Sun Avenue and Asylum Pike, a distance of a few miles from the Allegheny Avenue plant.

7. Deponent in his work as analytical chemist in the chemical laboratory in Crescentville plant analyzed samples from the new oxide mills as a part of his routine duties. In this connection the laboratory received one sample for each shift for each mill during operation; with three shifts a day and four mills in 1923 the laboratory received twelve samples per day whereas in 1924 with eight mills running, the laboratory received twenty-four samples per day. These samples were received practically every day throughout the year showing continuous operation of the mills at the Crescentville plant compared with the intermittent operation of the "ex-

perimental mill'' at the Nineteenth Street near Allegheny Avenue plant.

8. Deponent in 1921 and 1922, when he received these samples from ''the experimental mill,'' made two different types of tests on each sample, one the percentage oxidation test, two, the screen test. The first test determined the amount of PbO in the sample and the second determined the fineness of the material. Deponent knew at the time that various percentages of oxidation were found in samples from ''the experimental mill'' and from time to time that various percentages passed the 200 mesh screen.

9. Frequently during the years 1921 and 1922, Mr. Hall came into the chemical laboratory where deponent made the analyses and discussed the matters of this experimental work with the chemist in charge so that deponent learned the nature of Hall's work from time to time.

10. Whereas deponent knew as a matter of fact that the production from the Crescentville mills was used continuously in standard plate production, deponent does not know and does not believe that any powder produced from ''the experimental mill'' was used in the regular commercial production work of plates for storage batteries in 1921. On the contrary, deponent knows that during 1921 a large percentage of material produced by ''the experimental mill'' was rejected as unfit for testing in storage batteries and scrapped in accordance with the general practice at The Electric Storage Battery Company plant.

11. Deponent's routine work as chemical analyst and in process control included testing both experimental and standard product materials so that in connection with deponent's regular activities he soon learned whenever an experimental process had reached a point of commercial satisfaction. It was not until July, 1923, when the mills erected at Crescentville began production on a commercial scale that deponent had any knowledge of any commercial operation of the process or of any commercial utilization of the product.

12. During the year 1921 the amount of powder produced by the experimental mill was so small as to be insufficient to indicate the success of the method for producing quantities for commercial purposes, especially as compared with the millions of pounds of litharge and of red lead purchased by the Company in the years 1921 and 1922, the amounts of which deponent knew because each drum received was numbered consecutively and the samples received in the chemical laboratory were identified by the numbers of the drums from which they were taken. Deponent recalls that during the years 1921 and 1922 the drum numbers were extremely high, indicating the purchase of millions of pounds referred to.

13. Deponent has examined several of the exhibits introduced by The Electric Storage Battery Company and from his experience and intimate contact with the production of oxide material states that in view of the intermittent production and the small number of pounds per hour produced by the "experimental mill" contrasted with the production per mill with which deponent was connected at the Crescentville plant, deponent does not

regard any production in the year 1921 as commercial production for storage battery purposes under the Hall process.

14. Deponent further states to the best of his knowledge and belief that throughout the years 1921 and 1922 no visitors were ever permitted in the "experimental mill" building of The Electric Storage Battery Company; that even at the Crescentville plant, visitors were not permitted to enter the gray oxide plant; that deponent distinctly remembers that a foreman regularly employed in another department by the company was ordered out of the Crescentville gray oxide plant; and that a sign was posted up instructing persons not employed in that department to keep out.

CLARENCE J. TRESTON

Sworn to and subscribed before me this 6th day of May, 1939.

L. W. KAHL,
Notary Public, Lucas County, Ohio,
My commission expires Jan. 9, 1940.

(Seal)

AFFIDAVIT OF JOHN J. DEEGAN

STATE OF PENNSYLVANIA }
COUNTY OF PHILADELPHIA } ss.

JOHN J. DEEGAN, being first duly sworn, deposes and says:

He is of lawful age, and a resident of the City of Philadelphia, Pennsylvania, 4549 North Fifth Street, and at present is employed by the Pennsylvania Liquor Control Board, and has been so employed since October, 1935.

Prior to 1920, deponent attended the University of Pennsylvania, and there engaged in the study of chemistry for a period of time.

On or about the first day of October, 1920, deponent was employed by the Electric Storage Battery Company as a chemist in the laboratory of the said company, which laboratory was housed in a building at the southeast corner of 19th Street and Allegheny Avenue, Philadelphia, Pennsylvania.

During the balance of the year 1920, and the years 1921, 1922, and up to July, 1923, while deponent was employed in said building at 19th Street and Allegheny Avenue, deponent's duties included the testing of samples of lead oxides, including red lead and litharge, and other materials used in the construction of storage batteries.

Durin the years 1921 and 1922, samples of so-called lead dust or grey oxide were brought into the laboratory at various intervals, and that deponent made tests of some of these samples received by the laboratory, the tests being for fineness of material.

Deponent further states that he became personally acquainted with one Clarence A. Hall, who was also in the employ of the Electric Storage Battery Company during said years, and that the deponent knew that the men who delivered the samples of lead dust or grey oxide for test purposes to the laboratory were men employed in a separate building located on the west side of 19th Street about one-half block north of Allegheny Avenue, Philadelphia, and were engaged in operating an experimental mill in said building.

Deponent was instructed not to enter said building, but personally knew that the samples of material which he tested came from the building which deponent was instructed not to enter; that it was a general instruction at the plant that no members of the testing laboratory in which deponent was employed were permitted to enter the building housing the experimental mill.

That during the year 1921, the samples of lead dust or grey oxide received by the laboratory for test purposes were not received regularly, but at varying intervals, and that during 1922 the samples for testing were received at more regular intervals by the laboratory for test purposes.

JOHN J. DEEGAN,

Sworn to and subscribed before me this 8th day of May, 1939.

HOWARD T. LONG.
Notary Public.
My commission expires April 4, 1941.

Notary Public
(Seal)
Philadelphia County, Pa.



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IN THE

Supreme Court of the United States

October Term, 1938.

No. 441.

THE ELECTRIC STORAGE BATTERY CO.,
Petitioner,

v.

GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION,
Respondents.

Petition for Rehearing on Behalf of Petitioner, The Electric Storage Battery Co.

HUGH M. MORRIS,
Attorney for Petitioners.

A. B. STOUGHTON,
A. F. KWIS,
E. S. W. FARNUM,
ALEXANDER L. NICHOLS,
Counsel for Petitioner.

International, 236 Chestnut St., Philadelphia

INDEX.

Page

I. The Patent Statutes of the United States, at Least Since the Enactment of Section 15 of the Patent Statute of 1836, Have Disclosed and Established a Congressional Policy of Favoring Him Who Makes an Invention in This Country as Against One Who Earlier Makes the Same Invention Abroad But Does Not Patent or Publish the Foreign Invention Before the Like Invention Is Made Here. Yet, the Decision of This Court in the Case at Bar Would Seem to Reverse the Century Old Policy So Established by the Congress..... 2

II. In Holding That in an Infringement Suit by the Owner of a Patent for an Invention, Made But Not Patented or Published Abroad, to Restrain an Innocent Use, the Inception of Which Antedates the Application for the Patent, and the Importation of the Foreign Made Invention into This Country, the Plaintiff May Prove That His Actual Date of Invention Was Earlier Than the Asserted Infringing Use, This Court, It Is Believed, Failed to Give Effect to the True Purpose and Intention of the Congress in Adding, by the Patent Act of 1870, the Words "in This Country" Immediately Following the Words "Not Known or Used by Others," in What Is Now R. S. Sec. 4886 4

INDEX—Continued.

Page

III. By Its Construction of R. S. 4886 in the Instant Case, the Court, It Is Believed, Has Inadvertently Overlooked the Construction Put Upon That Statute by the Congress Itself, upon Which Petitioner's Contention Here Made Is in Large Measure Based 8

CASES CITED.

	Page
Corona Co. v. Dovan Corp., 276 U. S. 358, 384-385	3, 7
Dawson v. Follen, Fed. Cas. 3670	4
Gayler v. Wilder, 10 Howard 477, 497	2, 5, 10
Milburn Co. v. Davis etc. Co., 270 U. S. 390, 401	6
Pennock v. Dialogue, 2 Peters 1, 20-22	4
Sewell v. Jones, 91 U. S. 171, 179-180	4

STATUTES CITED.

	Page
Act of March 1903	8
Act of March 3, 1921, 41 Stat. 1314, 35 USC Sec. 85	9
Patent Act of 1870	2, 4, 5, 6, 10
Patent Act of 1836	2, 5
R. S. Sec. 4886	3, 6, 10
R. S. Sec. 4887	2, 8, 9, 10
R. S. Sec. 4923	3, 5, 6
Sec. 6 of Nolan Act	2, 9, 10
32 Stat. 1225	8

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GENZO SHIMADZU AND NORTHEASTERN ENGINEERING CORPORATION,

Respondents.

PETITION FOR REHEARING ON BEHALF OF PETITIONER, THE ELECTRIC STORAGE BATTERY CO.

To the Honorable the Chief Justice and the Associate Justices of the Supreme Court of the United States:

Petitioner, The Electric Storage Battery Co., respectfully petitions the Court for a rehearing [1] in the above-entitled cause, for the following reasons and upon the following grounds.

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[1] Judgment of this Court was entered herein on April 17, 1939. Three questions (opinion, p. 2) presented by the Petition for the Writ of Certiorari, were passed upon by this Court in its consideration and decision of the case. The first and second of such questions, relating respectively to priority of invention and abandonment, were decided adversely to the contentions of petitioner. The third of such questions, relating to public use, was decided adversely to respondent. This petition is addressed solely to the decision of this Court upon the question of priority of invention.

I.

The Patent Statutes of the United States, at Least Since the Enactment of Section 15 of the Patent Statute of 1836, have Disclosed and Established a Congressional Policy of Favoring Him Who Makes an Invention in This Country as Against One Who Earlier Makes the Same Invention Abroad But Does Not Patent or Publish the Foreign Invention Before the Like Invention Is Made Here. Yet, the Decision of This Court in the Case at Bar Would Seem to Reverse the Century Old Policy So Established by the Congress.

By Section 15 of the Patent Statute of 1836, now R. S. 4923, the Congress established the policy of favoring, to the extent there provided, one who makes an invention in this country as against one who earlier made the same invention abroad if the invention so made abroad was not patented or published before the same invention was made in this country.

This Court recognized this policy of the Congress and its Statutes in **Gayler v. Wilder**, 10 Howard 477, 497.

By the Patent Statute of 1870 interpolating the words "in this country" in what is now R. S. 4886, the Congress did not change the existing policy evidenced by Section 15 of the Patent Statute of 1836 and by Gayler v. Wilder, but it enlarged and extended the then existing policy favoring inventions made here as against those made abroad.

The Congress further recognized the aforesaid preferential character of the Patent Statutes by the amendment of 1903 to R. S. 4887.

Again the Congress recognized the long existing policy of the Statutes so favoring inventions made in this country by the provisions of the Nolan Act.

This Court by its decision in the case at bar seems, however, to have reversed the century old preferential character of the Patent Statutes, recognized by this Court in Gayler v. Wilder, and to have given preference to him who made an unpatented and unpublished invention abroad instead of to him who later made the same invention in this country.

True, this case is not, strictly speaking, a contest between rival inventors yet, in effect, it is such a contest, for, the American public here stands in the shoes of the inventor of the process which was in public use by petitioner in June 1921. Petitioner is a member of that American public.

Were this proposition not sound an invention abandoned by one inventor would pass to and enure to the benefit of another inventor instead of to the American public. That an abandoned invention enures to the benefit of the American public and not to some other inventor was established by this court in **Corona Co. v. Dovan Corp.**, 276 U. S. 358, 384-385.

That a patent granted under R. S. 4886 cannot be held to be void because the invention or discovery, or any part thereof was known or used in a foreign country before his (patentee's) invention or discovery thereof is established by R. S. 4923.

If a person having the inchoate right to obtain a patent under R. S. 4886 renounces that right the right to the invention vests in the public.

The invention made in this country was in public use in this country in June 1921 by a member of the American Public. By the decision of this Court the right of the public to the use of that invention was not only denied because of Shimadzu's knowledge and use thereof in Japan in 1919 but Shimadzu was held to be entitled to a patent therefor.

This would seem to give to the patent statutes a preferential character in favor of inventions made abroad as against the contrary century old statutory preference in favor of inventions made in this country if the earlier invention made abroad had not been patented or published.

II.

In Holding That in an Infringement Suit by the Owner of a Patent for an Invention, Made But Not Patented or Published Abroad, to Restrain an Innocent Use, the Inception of Which Antedates the Application for the Patent, and the Importation of the Foreign Made Invention into This Country, the Plaintiff May Prove That His Actual Date of Invention Was Earlier Than the Asserted Infringing Use, This Court, It Is Believed, Failed to Give Effect to the True Purpose and Intention of the Congress in Adding, by the Patent Act of 1870 [2], the Words "in This Country" Immediately Following the Words "Not Known or Used by Others", in What Is Now R. S. Sec. 4886.

Prior to the Patent Act of 1870, invention or want of invention, was made to depend [3] upon whether or not the thing alleged to have been invented was "known or used by others before his or their invention or discovery thereof", the other conditions and requirements of the Statute being fulfilled.[4] As interpreted by the Courts [5] the earlier Statute was held to require that an invention, to be

[2] 16 Stat. 198, Sec. 24.

[3] Patent Act of 1836, 5 Stat. 117, Sec. 6.

[4] No question as to such other requirements or the construction of the Statute in respect thereof is here involved.

[5] Sewell v. Jones, 91 U. S. 171, 179-180; Pennock v. Dialogue, 2 Peters 1, 20-22; Dawson v. Follen, Fed. Cas. 3670.

novel, must have been first in point of time as against knowledge and use thereof existing anywhere in the world. **By the Patent Act of 1870, however, knowledge and use, to deprive an invention here made of the quality of novelty, must be knowledge or use possessed or exercised by "others in this country".***

Furthermore, it would seem manifest that by the amendment of the Statute, effected by the Patent Act of 1870, the Congress intended merely to make the Statute, now Section 4886, expressly conform to that to which had theretofore been declared [6] by this Court on the basis of Sections 6 [7] and 15 [8] of the Patent Act of 1836, to be the law.

But indeed, the Statute became, by virtue of the amendment of 1870, even more comprehensive in effect than was the combined effect of Sections 6 and 15 of the Patent Act of 1836, in that Section 15 gave protection against prior unpatented and unpublished knowledge and use of the invention in a foreign country only to one who was a patentee in this country and who, at the time of his invention or discovery, believed himself to be the first inventor; whereas, the right to the status of first inventor given by the Patent Act of 1870 to one who independently made his invention or discovery in this country, was not dependent upon proof of his belief as to whether or not he was then the first inventor, but was, as to unpatented and unpublished knowledge and use abroad, absolute and unconditional. Insofar as invention depends upon knowledge and use of the thing invented by others, the provisions of the Patent Act of 1870 have not since been altered. It therefore appears that the provisions

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* Emphasis throughout petition is counsels'.

[6] Gayler v. Wilder, 10 How. 477, 497.

[7] Now R. S. Sec. 4886.

[8] Now R. S. Sec. 4923.

of R. S. Sec. 4923, so enlarged and extended, have now been incorporated in R. S. Sec. 4886.

The inevitable consequence of the amendment of the Statute effected by the Patent Act of 1870, which has been carried into R. S. 4886, is, we submit, to give to one in this country (whose identity need not even be known[9]), "who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or any new and useful improvements thereof, not known or used by others in this country before his invention or discovery thereof", the status of first inventor in all cases, and to his invention or discovery, the status of novelty, irrespective of prior knowledge or use in a foreign country of the thing so independently invented or discovered in this country.

That status is here applicable to the inventor of petitioner's process and to the process itself, for it is that very process (so established by the decrees of infringement entered by the Courts below), which was in public use in this country in June, 1921, many months prior to any knowledge or means of knowledge in this country of Shimadzu's earlier knowledge and use thereof in Japan.

That such first inventor of petitioner's process did not apply for or receive a patent for his invention cannot, it is submitted, deprive him of his status as first inventor or destroy the status of novelty accorded by the Statute to his invention. He became the first inventor and his invention acquired the status of novelty when he met the requirements of R. S. Sec. 4886, which alone need be satisfied to create that status.

The Statute does not make that right and status of the first inventor forfeit because of a failure to apply for a pat-

[9] Milburn Co. v. Davis etc. Co., 270 U. S. 390, 401.

ent or because of a dedication of the invention to the public. The right conferred by the Statute upon the first inventor to obtain a patent for his invention may, of course, become forfeited through failure or delay in making timely application. But such failure or delay inures solely to the benefit of the American public and confers upon an inventor who thereafter seeks to bring the same invention within the scope and field of operation of the Patent Statutes of this country no right to obtain a patent for that of which he was not, in contemplation of the Patent Laws of the United States, the first inventor.[10]

To require, as the Court's construction of the Statute seems to do, that one making an invention in this country shall, to establish his right of priority and novelty as against an earlier though unpatented and unpublished invention made abroad, patent his invention or apply for a patent therefor, would seem to interpolate into the Statute a further condition precedent to the status of first inventor not found therein.

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[10] In **Corona Co. v. Dovan Corp.**, 276 U. S. 358, 384-385, this Court said:

> "If Kratz discovered and completed, as we are convinced that he did, the first use of D.P.G. as an accelerator in making vulcanized rubber, he does not lose his right to use this discovery when he chooses to do so, for scientific purposes or purposes of publication, because he does not subsequently sell the rubber thus vulcanized, or use his discovery in trade, or **does not apply for at patent for it.** . . It is doubtless true that Kratz, by his course in respect to his discovery as to the use of D.P.G., has abandoned any claim **as against the public** for a patent, but that is a very different thing from saying that it was abandoned as against a subsequent discoverer or patentee."

Petitioner does not ask the Court to write into the Statute the words "in this country" after the words "before his invention or discovery thereof". The Congress, we believe has already made clear, by the amendment of 1870, that one who makes an invention in this country is the first inventor as against one who made the same invention earlier abroad but who had not patented or published his invention or brought it to this country prior to the date of the invention made here. But with far more reason, we submit might those words, if necessary, be supplied, than that there should be read into the Statute a provision forfeiting the rights of priority and novelty conferred by the Statute upon one making an invention in this country, unless a patent for the American invention be applied for.

III.

By Its Construction of R. S. 4886 in the Instant Case, the Court, It Is Believed, Has Inadvertently Overlooked the Construction Put Upon That Statute by the Congress Itself, upon Which Petitioner's Contention Here Made Is in Large Measure Based.

Thus, by the Act of March 3, 1903,[11] the Congress amended R. S. Sec. 4887 by adding thereto a new provision giving to an application for patent for an invention or discovery filed in this country by any person who has previously regularly filed an application for the same invention or discovery in a foreign country which, by treaty, convention, or law, affords similar privileges to citizens of the United States the same force and effect as the same application would have if filed in this country on the date on which the application for patent for the same invention or discov-

[11] 32 Stat. 1225.

ery was first filed in such foreign country, provided the application in this country is filed within twelve months from the earliest date on which any such foreign application was filed.

It is true, as pointed out in the decision of the Court (opinion, p. 4), that the purpose of that Statute "is to permit the filing of applications for the same invention in foreign countries and in the United States" and that the amendment thereof by the Act of 1903 had for its purpose the fulfillment of reciprocal agreements with foreign countries. **But that very fact serves to establish, it is believed, that without such enabling amendment the Patent Statutes of this country conferred upon foreign inventors no right to take back the date of their inventions, as against knowledge and use thereof existing in this country, even by proof of prior applications filed in a foreign country.** And indeed if such were not the effect of the then existing patent laws, there would appear to have been no necessity whatever for so amending R. S. 4887.

Again, in Section 6 of the Nolan Act [12] the Congress provided:

> "Where an invention was made by a person while serving abroad, during the World War, with the forces of the United States, civil or military, the inventor thereof shall be entitled, in interference **and other proceedings** arising in connection with such invention, **to the same rights of priority with respect to such invention as if the same had been made in the United States.** (Mar. 3, 1921, c. 126 § 6, 41 Stat. 1314)."

If foreign inventors had been deemed by Congress to be entitled under the then existing law to the same rights of priority with respect to inventions made abroad as if the

[12] Act of March 3, 1921, 41 Stat. 1314, 35 USC Sec. 85.

same had been made in the United States, the same rights would manifestly have been available to persons making inventions abroad while serving during the World War with the forces of the United States, civil or military, and Section 6 of the Nolan Act would have been a clear act of supererogation.

That the Congress did not construe the then existing law as giving to anyone making an invention in a foreign country the same rights of priority in interference and other proceedings as if the same had been made in the United States, is, we believe, demonstrated by the Nolan Act.

The Court holds (opinion, p. 6) that the Congress has, by its failure to amend R. S. 4886 in the light of inferior Court decisions permitting a foreign inventor to establish priority as against unpatented knowledge and use of the same invention in this country by proof of an earlier actual date of invention abroad, impliedly approved such decisions.

It is submitted, however, that the failure of the Congress to amend R. S. Sec. 4886 subsequent to such inferior Court decisions, is squarely met and overcome by the construction which the Congress has itself put upon that section in the amendment of R. S. Sec. 4887 by the Act of March 3, 1903, and by the Nolan Act, and that the true explanation of the failure of the Congress further to amend R. S. 4886 lies in the fact that the Congress itself believed that it had already made effective such amendment (in conformity with the decision of this Court in Gayler v. Wilder, 10 How. 477, 497) in and by the Patent Act of 1870.

WHEREFORE, petitioner prays that this petition for rehearing be granted and that the mandate of this Court be withheld pending the determination thereof by this Court,

and for such further time as the Court may order in the event this petition shall be granted.

Respectfully submitted,

HUGH M. MORRIS,
Attorney for Petitioners.

A. B. STOUGHTON,
A. F. KWIS,
E. S. W. FARNUM,
ALEXANDER L. NICHOLS,
Counsel for Petitioner.

I, Hugh M. Morris, counsel for The Electric Storage Battery Co., the petitioner above named, do hereby certify that the foregoing petition for rehearing is in my opinion well founded in law and that it is presented in good faith and not for delay:

May 12, 1939.

HUGH M. MORRIS.

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Supreme Court, U. S.
FILED
MAY 16 1939
CHARLES ELMORE CROPLEY
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IN THE

Supreme Court of the United States

No. 441.—October Term, 1938.

The Electric Storage Battery Company, *Petitioner*,

v.

Genzo Shimadzu and Northeastern Engineering Corporation, *Respondents*.

RESPONDENTS' REPLY TO PETITIONER'S APPLICATION FOR REHEARING.

Petitioner's application for rehearing is limited (footnote, p. 1) solely to Point I of its original petition for writ of certiorari—*i. e.*, the right of respondents to prove and rely upon the actual dates of invention in a foreign country, instead of being arbitrarily limited to an artificial date such as the date of the introduction of the invention into the United States.

Unlike the petition for correction of opinion and rehearing filed by respondents, the petitioner's application for rehearing merely reiterates matters already considered. It does not point to any matter overlooked or misapprehended, nor adduce any new statute, clause of a statute, any new decision, any new argument or thought not already pre-

sented to and fully considered by this Court upon the briefs and argument.

The opinion of the Court herein of April 17, 1939, fully considers the various applicable patent statutes, their legislative history, and the decisions thereunder, together with the policy and intent of the Congress in adopting those statutes. The petition merely asks the Court to retrace the ground it has already covered.[1]

Respondents need not here repeat the answers to the matters raised in petitioner's present application. The three points now urged are fully answered in respondents' briefs on file with this Court. Point I, as to the policy of the law, is fully covered in respondents' main brief, more particularly pp. 21-22, and 29-32. Point II, as to the interpretation of R. S. §4886, is answered in respondents' main brief, pp. 10-18, 23, *et passim;* reply brief, pp. 2-7; and as to no dedication,[2] main brief, pp. 26-27. Point III, as to the effect of the Nolan Act, is answered in respondents' main brief, p. 24.

Respectfully submitted,

EDMUND B. WHITCOMB,
GEO. WHITFIELD BETTS, JR.,
JOSEPH W. HENDERSON,
Counsel for Respondents.

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GEORGE YAMAOKA,
Of Counsel.

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[1] Thus, the present petition now tacitly concedes, p. 8, that the words "in this country" should be interpolated by judicial construction into R. S. §4886, notwithstanding the Congress itself has refused so to amend the statute. As this Court said in its opinion of April 17, 1939, "We cannot thus rewrite the statute."

[2] In *Kendall* v. *Winsor*, 21 How. 322, there was no dedication to the *public*, but to another *inventor*.

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IN THE

Supreme Court of the United States

October Term, 1938.

No. 441.

THE ELECTRIC STORAGE BATTERY CO.,
Petitioner,

v.

GENZO SHIMADZU and NORTHEASTERN ENGINEERING CORPORATION,
Respondents.

Petitioner's Reply to Respondents' Motion for Leave to File a Second Petition for Modification of the Decision and Judgment of This Court Herein and for Recall and Modification of Its Mandate.

HUGH M. MORRIS,
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A. B. STOUGHTON,
A. F. KWIS,
E. S. W. FARNUM,
ALEXANDER L. NICHOLS,
Counsel for Petitioner.

IN THE

Supreme Court of the United States.

No. 441. October Term, 1938.

THE ELECTRIC STORAGE BATTERY COMPANY,

Petitioner,

v.

GENZO SHIMADZU AND NORTHEASTERN ENGINEERING CORPORATION,

Respondents.

PETITIONER'S REPLY TO RESPONDENTS' MOTION FOR LEAVE TO FILE A SECOND PETITION FOR MODIFICATION OF THE DECISION AND JUDGMENT OF THIS COURT HEREIN AND FOR RECALL AND MODIFICATION OF ITS MANDATE.

I.

Respondents' Point 1, urging that this Court further modify its opinion in order further to point out that the claims of Patent No. 1,584,150 invalidated by the decision of this court are only those in issue, approaches the frivolous.

The modification of the opinion made May 22, 1939 already makes clear that the claims of Patent No. 1,584,150, invalidated by this Court, are only "the claims in issue".

II.

Respondents seek to have this Court give an effective date to Claims 1, 2, 3, 9, 11 and 12 of Patent No. 1,584,150 and Claims 10 and 11 of Patent No. 1,896,020 as of January 30, 1922, the date of the filing of the application for Patent No. 1,584,149, notwithstanding the applications for Patents Nos. 1,584,150 and 1,896,020 were filed more than two years after public use by petitioner of the subject matter of those claims.

It is, of course, to be observed that neither Patent No. 1,584,150 nor No. 1,896,020, claims upon its face to be a continuation either in whole or in part of the application for Patent No. 1,584,149.

Moreover, neither the application for Patent No. 1,584,150 nor the application for Patent No. 1,896,020 is, in law or fact, a continuation application of the application for Patent No. 1,584,149.

In Patent No. 1,584,149, "the air current is introduced into the vessel for the purpose of removing the powder formed by attrition of the lead masses. This patent contains no suggestion of the oxidizing effect of the air or of temperature control". (R. II, 1167). The process is to be carried out at non-elevated temperatures. (Patent No. 1,584,149, page 1, lines 91-96). This is true of the application for Patent 1,584,149 as filed.

Patent No. 1,584,150, on the contrary, not only calls for oxidation, but oxidation prior to abrasion. In addition, it discloses a process to be carried out, not at room temperature, but at a controlled elevated temperature.

But even if Patents Nos. 1,584,150 and 1,896,020 could be considered, in law or fact, continuing applications of

application for Patent No. 1,584,149, nevertheless Claims 1, 2, 3, 9, 11 and 12 of Patent No. 1,584,150 could not be given an effective date as of the date of the filing of the original application for Patent No. 1,584,149, in that the original application was amended in several substantial particulars as is shown by the file wrapper and contents thereof (Pltfs. Exhibit 2); as for example, in the original application as filed, the revolution of the mill was specified (p. 3, line 17) as "at a rate of 15-25 times per *hour*". It was not until January of 1926 that "hour" was changed to "minute". (Pltfs. Exhibit 2, page 35).

In Patent No. 1,584,150, the cylinder rotates "at a rate of 25 times in one minute". (Patent No. 1,584,150, page 1, line 97).

Furthermore, by reason of the two years' public use by petitioner, The Electric Storage Battery Company, of the invention of Claims 1, 2, 3, 9, 11 and 12 of Patent No. 1,584,150 and Claims 10 and 11 of Patent No. 1,896,020, and the consequent intervening rights of petitioner and the public, respondents are barred from successfully contending that the applications for Patents Nos. 1,584,150 and 1,896,020 are continuation applications of the original application for Patent No. 1,584,149. *General Pictures Co. v. Electric Co.*, 304 U. S. 175, 183.

III.

Now that this Court has decided the question of public use and has refused to reconsider that question, respondents seek for the first time to have that issue referred to some other Court for determination.

This, in effect, is a request by respondents that this Court permit an appeal by respondents from the finding and judgment of this Court to the District Court.

The second petition for modification of the decision and judgment of this Court and for recall and modification of its mandate, should be denied.

Respectfully submitted,

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A. B. STOUGHTON,
A. E. KWIS,
E. S. W. FARNUM, JR.,
ALEXANDER L. NICHOLS,
Counsel for Petitioner.

June 2, 1939.

pp. 11+12.

SUPREME COURT OF THE UNITED STATES.

No. 441.—October Term, 1938.

The Electric Storage Battery Company, Petitioner,
vs.
Genzo Shimadzu and Northeastern Engineering Corporation.

On Writ of Certiorari to the United States Circuit Court of Appeals for the Third Circuit.

[April 17, 1939.]

Mr. Justice Roberts delivered the opinion of the Court.

The courts below have held valid and infringed certain claims of three patents[1] granted to Genzo Shimadzu, a citizen and resident of Japan. The earliest is for a method of forming a finely divided and, consequently, more chemically reactive, lead powder. The second is for a method or process of manufacturing a fine powder composed of lead suboxide and metallic lead and for the product of the process. The third is for an apparatus for the continuous production of lead oxides in the form of a dry fine powder. Such powder is useful in the manufacture of plates for storage batteries.

The bill was filed by the respondents as patentee and exclusive licensee. The answer denied that Shimadzu was the first inventor; asserted knowledge and use of the invention by the petitioner in the United States more than two years prior to the dates of the applications; and pleaded that earlier patents procured by Shimadzu in Japan avoided the United States patents as the former were for the same inventions and each was granted more than a year prior to the filing of the corresponding application in this country. The case was tried, the District Court found the facts, stated its conclusions, and entered a decree for the respondents,[2] which the Circuit Court of Appeals affirmed.[3] The

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Patents	*Date granted*	*Claims*
1,584,149	5/11/1926	1 and 2
1,584,150	5/11/1926	1-4, 6, 8-13
1,896,020	1/31/1933	10 and 11

2 17 F. Supp. 42.

3 98 F. (2d) 831.

petitioner sought certiorari alleging that the case presents three questions, one which should be settled by this court and two which were decided below contrary to our adjudications.

The questions are: In an infringement suit by the owner of a patent for an invention, made but not patented or published abroad, to restrain an innocent use, the inception of which antedates the application for patent, may the plaintiff prove that his actual date of invention was earlier than the commencement of the asserted infringing use? Is the delay of the patentee in this case in applying for patent a bar to relief for alleged infringement? Does commercial use of the patented process and apparatus in the alleged infringer's plant for more than two years prior to the application for patent preclude redress?

No controversy of fact is involved as the petitioner concedes it must accept the concurrent findings of the courts below.[4] The relevant facts lie within a narrow compass.

The inventions which are the basis of the patents were conceived by Shimadzu and reduced to practise in Japan not later than August 1919. He did not disclose the inventions to anyone in the United States before he applied for United States patents. Application was presented for No. 1,584,149 on January 30, 1922; for No. 1,584,150 on July 14, 1923; and for No. 1,896,020 on April 27, 1926. The inventions were not patented or described in a printed publication in this or any foreign country prior to the filing of the applications. The petitioner, without knowledge of Shimadzu's inventions, began the use of a machine, which involved both the method and the apparatus of the patents, at Philadelphia, Pennsylvania, early in 1921 and attained commercial production in June 1921. Over the objection of the petitioner the respondents were permitted by testimony, and by the introduction of contemporaneous drawings and note books, to carry the date of invention back to August 1919, and the courts below fixed that as the date of invention and reduction to practise in Japan.

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[4] At the trial the respondents relied, to some extent, upon an adjudication in an interference proceeding between Shimadzu and Hall, an employe of the petitioner who in 1924 applied for a patent for a process of producing finely powdered mixed lead and lead oxide. See Hall v. Shimadzu, 59 F. (2d) 225. The courts below have held that this interference has no bearing upon the present controversy and their holding in this respect involves questions of fact. As the respondents did not cross-petition they may not, in this court, attack the findings in question.

First. The petitioner asserts that R. S. 4886, 4887, and 4923,[5] considered together, require one who has made an invention abroad to take as his date of invention the date of his application in the United States unless, prior thereto, the invention has been communicated and described to someone in this country, or has been patented abroad. The respondents insist that the sections have no such force. They say that where the alleged infringer is not acting under the supposed protection of a prior patent, but is using an unpatented process or device, the holder of a patent for a foreign invention, like the holder of one for an invention made here, may show novelty by proving that his invention antedated his application and the infringing use.

The solution of the issue requires examination of two of the sections in the light of their development from earlier patent statutes.

R. S. 4886, as it stood when the patents were granted,[6] was:

"Any person who has invented or discovered any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvements thereof, not known or used by others [in this country], [before his invention or discovery thereof], and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, [or more than two years prior to his application], and not in public use or on sale [in this country] for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceeding had, obtain a patent therefor."

The legislative history of the section may be briefly outlined. The Patent Act of 1790[7] authorized the grant of a patent to "any person or persons" who made an invention "not before known or used." The succeeding Act of 1793[8] confined the privilege to "a citizen or citizens of the United States", but the Act of 1800[9] conferred it on any alien who, at the time of his application, had resided for two years within the United States. By the Act of 1836[10] it was provided that a patent might be obtained by "any

[5] U. S. C. Tit. 35, §§ 31, 32, 72.

[6] The section was amended by the Act of May 23, 1930, c. 312, § 1, 46 Stat. 376, to authorize the patenting of inventions of certain plants.

[7] Act of April 10, 1790, § 1, 1 Stat. 109.

[8] Act of Feb. 21, 1793, § 1, 1 Stat. 318.

[9] Act of April 17, 1800, § 1, 2 Stat. 37.

[10] Act of July 4, 1836, § 6, 5 Stat. 117, 119.

person or persons." The Act of 1870,[11] which was carried into the Revised Statutes, added the words "in this country" as they appear in the first bracket in the foregoing quotation. The Act of 1897[12] added the three other bracketed clauses.

The requirement of the Act of 1790 was that the discovery be "not before known or used." The Act of 1793 amended this to read "not known or used before the application." The Act of 1800 altered the provision so that the petitioner had to swear that his invention had not "been known or used either in this or any foreign country." The Act of 1836 changed the knowledge and use clause to read "not known or used by others before his or their discovery or invention thereof."

These successive alterations throw into relief the fact that the section makes the criterion of novelty the same whether the invention was conceived abroad or in this country. The test is whether the invention was "known or used by others in this country, before his invention or discovery thereof" . . . The elements which preclude patentability are a patent, or a description in a printed publication in this or any foreign country, which antedates the invention or discovery of the applicant.

None of the statutes has ever embodied as an element the place of invention or discovery, but the change effected by the Act of 1836, and carried forward in all succeeding statutes, is the fixation of the actual date of the inventive act as the date prior to which the invention must have been known or used to justify denial of a patent for want of novelty. The omission of any limitation as to the place of invention or discovery precludes a ruling imposing such a limitation, especially so since the Act of 1870 expressly limited the area of prior knowledge or use to this country.

The provisions of R. S. 4886 which affect the question are not modified by R. S. 4887, the purpose of which is to permit the filing of applications for the same invention in foreign countries and in the United States. It derives from Section 25 of the Act of 1870.[13]

The second paragraph of the section, which was added by the Act of 1903[14] to comply with reciprocal agreements with foreign countries, gives the same force and effect to the filing of an appli-

[11] Act of July 8, 1870, c. 230, § 24, 16 Stat. 198, 201.
[12] Act of March 3, 1897, c. 391, § 1, 29 Stat. 692.
[13] § 25, 16 Stat. 201.
[14] Act of March 3, 1903, § 1, c. 1019, 32 Stat. 1226.

cation in a foreign country as it would have if filed here on the date on which the application for patent was first filed in the foreign country, provided that the domestic application is filed within twelve months of the foreign filing date. The last sentence of the paragraph expressly preserves the bars of more than two years' prior patenting, description in a printed publication before the filing of application in this country, and public use, more than two years before such filing. But the section does not contain any provision which precludes proof of facts respecting the actual date of invention in a foreign country to overcome the prior knowledge or use bar of § 4886.

The petitioner also relies upon R. S. 4923, which provides that if the patentee, at the time of his application, believed himself the original or first inventor, his patent shall not be refused or held void by reason of the invention having been known or used in a foreign country, before his invention or discovery, if it had not been patented or described in a printed publication. The effect of this section is that in an interference between two applicants for United States patent, or in an infringement suit where the alleged infringer relies upon a United States patent, the application and patent for the domestic invention shall have priority despite earlier foreign knowledge and use not evidenced by a prior patent or a description in a printed publication.

The section, on its face, is without application where the litigation is between the patentee of a foreign invention, or his assignee, and an alleged infringer who defends only in virtue of prior knowledge or use not covered by a patent.

While this court has never been called upon to decide the precise question presented, the lower federal courts have refused to extend § 4923 to such a case. They have held that § 4886 does not limit the plaintiff to the date of application in this country but that he may prove the invention was in fact made at an earlier date, as could the owner of an invention made in the United States.[15]

There is force in the petitioner's argument that the distinction seems illogical. Thus, if a diligent domestic inventor applies, in good faith believing himself to be the first inventor, Section 4923

[15] Hanifen *v.* E. H. Godshalk Co., 78 Fed. 811; Welsbach Light Co. *v.* Incandescent Lamp Co., 98 Fed. 613; Badische Anilin & Soda Fabrik *v.* Klipstein & Co., 125 Fed. 543; Claude Neon Lights, Inc. *v.* Rainbow Light, Inc., 47 F. (2d) 345.

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assures him a patent and gives it priority, despite prior foreign use, even though that use is evidenced by a patent applied for after the invention made in this country. The foreign applicant or patentee cannot carry the date of his invention back of the date of application in this country, as the holder of a later patent for an invention made here would be permitted to do in order to establish priority. On the other hand, a domestic inventor who is willing to dedicate his invention to the public may be held as an infringer by reason of the later patenting of an invention abroad which antedates the invention and use in this country; and so is put in a worse position vis a vis a foreign inventor who subsequently secures a patent, and succeeds in establishing an earlier date of invention, than he would occupy if he had promoted his own interest by procuring a patent.

We have no way of knowing whether the discrimination results from inadvertence or from some undisclosed legislative policy, but, in order to redress the disadvantage under which one in the petitioner's situation suffers, we should have to read into the law words which plainly are missing.[16] We cannot thus rewrite the statute.[17] Moreover, Sections 4886 and 4887 have repeatedly been amended and other portions of the patent act have been revised and amended from time to time since the decisions pointing out that Section 4886 did not prevent the foreign inventor from carrying back his date of invention beyond the date of his application. Congress has not seen fit to amend the statute in this respect and we must assume that it has been satisfied with, and adopted, the construction given to [illegible] enactment by the courts.[18]

We are of opinion that the courts below were right in not limiting Shimadzu's date of invention to the date of his application but allowing him to show an earlier actual date.

Second. A patent is not validly issued if the invention "is proved to have been abandoned."[19] Abandonment may be evi-

[16] The petitioner would have us insert in § 4886, for the third time, the words "in this country" which Congress has twice inserted in the section by amendment. The petitioner's argument requires us to read the section as if the phrase "in this country" appeared between the words "discovery thereof" and the words "and not patented".

[17] Dewey v. United States, 178 U. S. 510.

[18] Sessions v. Romadka, 145 U. S. 29, 41-42; Manhattan Properties, Inc. v. Irving Trust Co., 291 U. S. 320, 336; United States v. Elgin J. & E. R. Co., 298 U. S. 492, 500; Missouri v. Ross, 299 U. S. 72, 75.

[19] R. S. 4886, *supra*.

lenced by the express and voluntary declaration of the inventor;[20] t may be inferred from negligence or unexplained delay in making pplication for patent;[21] it may be declared as a consequence of he inventor's concealing his invention and delaying application or patent in an endeavor to extend the term of the patent protec- ion beyond the period fixed by the statute.[22] In any case, the ques- ion whether the invention has been abandoned is one of fact.[23]

Referring to a Japanese patent applied for November 27, 1920, nd issued May 10, 1922, the District Court found: "We are not oncerned with the motives which prompted him . . . to confine [the Japanese patent] to the single step of mechanical removal of he dust from the drum, and to withhold the really essential steps of he invention for later patenting. It is sufficient to say that he ad the right to do this if he chose." Taken in connection with he court's finding that Shimadzu's inventions were conceived and educed to practise in August 1919 this finding is said to convict im of intentional and inexcusable concealment. In the light of he record we are unable so to hold.

R. S. 4920[24] makes abandonment an affirmative defense which ust be pleaded and proved.[25] Admittedly the defense was not leaded and the respondents assert, without contradiction, that it as not relied upon in brief or argument in the courts below. The etitioner explains its failure so to plead by saying that, when it led its answer, it believed that certain of the Japanese patents sued to Shimadzu covered the identical inventions described in he patents in suit and invalidated the latter because application as not made in this country within one year of the grant of the oreign patents as required by R. S. 4887. The claim is that the efusal to sustain this defense and the assignment of August 1919 s the date of invention, took petitioner by surprise; and that the

[20] Kendall *v.* Winsor, 21 How. 322, 329; U. S. Rifle & Cartridge Co. *v.* Whitney Arms Co., 118 U. S. 22, 25.

[21] Consolidated Fruit-Jar Co. *v.* Wright, 94 U. S. 92, 96; U. S. Rifle & Cartridge Co. *v.* Whitney Arms Co., *supra*, p. 25.

[22] Kendall *v.* Winsor, *supra*, p. 328; Macbeth-Evans Glass Co. *v.* General Electric Co., 246 Fed. 695; Bliss Co. *v.* Southern Can Co., 251 Fed. 903; Victor Talking Machine Co. *v.* Starr Piano Co., 281 Fed. 60.

[23] Pennock *v.* Dialogue, 2 Pet. 1, 16.

[24] U. S. C. Tit. 35, Sec. 69.

[25] Crown Cork Co. *v.* Gutmann Co., 304 U. S. 159, 165. Compare Mumm *v.* Jacker & Sons, 301 U. S. 168, 171.

question of Shimadzu's concealment of his invention from 1919 until he made his applications in the United States did not emerge until the District Court's decision was rendered.

We think this is not a sufficient excuse for not pleading the defense. Alternative and inconsistent defenses may be pleaded.[26] Certainly if the petitioner was surprised it could at least have requested an opportunity to amend its answer. If the defense had been pleaded originally or by amendment the respondents would have had an opportunity to meet it by proof and this they appear not to have been afforded. We have a finding which seems not to have been addressed to this issue; and no findings as to the circumstances which led to the delay in filing applications. In the circumstances we think we are not justified in assigning to the findings below the force of a finding that Shimadzu, with intent, concealed his invention and delayed making applications for the purpose of unduly extending the life of his patents,—a defense not pleaded.

Third. If a valid patent is to issue, the invention must not have been in public use in this country for more than two years prior to the filing of the application.[27] Such public use is an affirmative defense to be pleaded and proved.[28] The respondents insist that it was not pleaded in this case and that the findings respecting the defense, on which the petitioner relies, are unsupported by the evidence. We cannot agree with either position.

Although not required so to do, the respondents in their bill pleaded with respect to each of the patents that the invention had not been in public use for more than two years before application filed. The petitioner denied the allegation as to each patent and, in addition, alleged that it was successfully making and selling the product of the invention in its plant long before it ever learned of Shimadzu's existence or his inventions, and further asserted that "the claims of said letters patent are invalid and void because the subject matter thereof was, prior to the alleged invention thereof by Shimadzu, and for more than two years prior to his application dates, known to and used by the defendant at Philadelphia, Penn-

[26] Jones *v.* Sewall, 13 Fed. Cas. 1017, 1028; Specialty Brass Co. v. Sette, 22 F. (2d) 964, 966; Walsh *v.* Wahle Co., 25 F. (2d) 350, 351.

[27] R. S. 4886, *supra*

[28] R. S. 4920, *supra;* Klein v. Seattle, 63 Fed. 702; Hookless Fastener Co. v. Rogers Co., 26 F. (2d) 264.

sylvania, . . .'' Upon the trial, employes of the petitioner described an early apparatus and process used in 1918 and 1919 and abandoned in the latter year when experiments began towards employment of the apparatus and process the petitioner now uses. They testified to the increasing perfection of the apparatus and process during the early months of 1921, and that commercial production was accomplished sometime between April and June of that year. Former employes of the petitioner were called by the respondents and described this apparatus and process as used and practised in the petitioner's plant in Philadelphia subsequent to the date of Shimadzu's applications, but the evidence indicates that, after its perfection in 1921, the same apparatus has been used, and the same process practised, from that date to the present. This is the apparatus and process which the courts below have held to infringe. The District Court found ''commercial production by the Hardinge mill with its forced air draft undoubtedly involved the use of the plaintiff's patent, and June, 1921, may be fixed as the date when that began.'' The respondents insist that this does not amount to a finding of prior public use, distinguishing between the court's phrase ''commercial production'' and the designation ''public use'' found in the statute. We think the position is untenable.

The finding of the District Court appears under a heading in its opinion entitled ''Alleged Prior Public Use.'' As originally promulgated the finding fixed January 1921 as the date of commercial production. The respondents sought a rehearing and asked that the finding as to commercial production in January 1921 be revised. A rehearing was granted and the District Judge filed a memorandum amending his opinion. In this he said: ''As to the second statement of fact, it may be said at once that it was never intended by the Court to make a finding of a prior public use (in the statutory sense of that term) by the defendant in January 1921.'' After discussing the use of the apparatus in the early months of 1921, the court said: ''It is therefore plain that there is no evidence of anything beyond an experimental use by the defendant earlier than about the middle of the year 1921. It is entirely possible that the word 'January' in the second statement of fact referred to above is a mere typographical error and that what the Court had in mind was, 'June'. However that may

be and in order to avoid any possible misunderstanding as to the scope of the finding, I will amend it to read 'Commercial production by the Hardinge mill with its forced air draft undoubtedly involved the use of the plaintiff's patent, and June, 1921, may be fixed as the date when that began.'"

Both parties appealed to the Circuit Court of Appeals. That the respondents understood the force and effect of the finding as to prior use is evident from their assignments, one of which is that the District Court erred "in finding and adjudging that commercial production by the Hardinge mill with its forced draft involving the use of plaintiff's patent began in June 1921."

It remains to determine whether the commercial use found is, in contemplation of law, a public use within the meaning of R. S. 4886. We hold that it is.

The earlier Acts provided that the bar should consist in public use or sale "with the applicant's consent or allowance prior to the application."[29] The Act of 1839[30] altered the clause to read "no patent shall be held to be invalid" except upon proof that "such . . . prior use has been for more than two years prior to such application for a patent." This court construed the later Act, which has been carried forward into the revised statutes, as rendering prior public use a bar whether the use was with or without the consent of the patentee.[31]

Decisions turning on prior public use have been numerous both in this court and in other federal courts; and the definition of such use, formulated when the statute made only use by consent a bar, has been adopted in instances where the use was without consent or knowledge of the applicant for patent.[32]

A mere experimental use is not the public use defined by the Act,[33] but a single use for profit, not purposely hidden, is such.[34]

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29 Act of July 4, 1836, Sec. 7, 5 Stat. 117, 119.

30 Act of March 3, 1839, Sec. 7, 5 Stat. 353, 354.

31 Andrews *v.* Hovey, 123 U. S. 267; on rehearing, 124 U. S. 694.

32 Detroit Lubricator Co. *v.* Lunkenheimer, 30 Fed. 190; United States Electric Lighting Co. *v.* Edison Lamp Co., 51 Fed. 24, 28; Front Rank Steel Furnace Co. *v.* Wrought Iron Range Co., 63 Fed. 995, 998; A. Schrader's Sons, Inc. *v.* Wein Sales Corp., 9 F. (2d) 306, 308; Twyman *v.* Radiant Glass Co., 56 F. (2d) 119; In re Martin, 74 F. (2d) 951; Paraffine Co. *v.* Everlast, 84 F. (2d) 335; Becker *v.* Electric Service Supplies Co., 98 F. (2d) 366.

33 Elizabeth *v.* Pavement Co., 97 U. S. 126, 134.

34 Consolidated Fruit-Jar Co. *v.* Wright, *supra*, 94; Egbert *v.* Lippmann, 104 U. S. 333, 336.

The ordinary use of a machine or the practise of a process in a factory in the usual course of producing articles for commercial purposes is a public use.[35]

In the present case the evidence is that the petitioner, since June 1921, has continuously employed the alleged infringing machine and process for the production of lead oxide powder used in the manufacture of plates for storage batteries which have been sold in quantity. There is no finding, and we think none would have been justified, to the effect that the machine, process, and product were not well known to the employes in the plant, or that efforts were made to conceal them from anyone who had a legitimate interest in understanding them.[36] This use, begun more than two years before Shimadzu applied for patents 1,584,150 and 1,896,020, invalidated ~~them~~ the claims in suit.

Fourth. The defense of prior public use is not made out against patent 1,584,149, for which application was filed January 30, 1922. The defendant's commercial production commenced about six months earlier. The District Court held the patent valid and infringed. Its claims cover merely a process for the production of a finely divided chemically reactive lead powder by introducing relatively large masses of lead into a rotatable vessel, rotating the vessel at a relatively low speed, forming the powder by attrition resulting from the rubbing of the masses against each other, and blowing the powder from the vessel by a current of air. The process and apparatus covered by the other two patents in issue involve use and control of an air current and use and control of temperature within the receptacle for the oxidation of the lead. With respect to 1,584,149 the trial court said:

"Whether or not '149 is for the same process as U. S. patent '150 is immaterial, so far as the question of validity of either is concerned. There is no double patenting involved. The two patents issued on the same day. They both expired on the same day. There can be no extension of the monopoly and one is not prior art against the other.

"The fact that '149 does not disclose the oxidizing function of the air or refer to the highly important element of the process having to do with the temperature control necessary to its successful operation might throw doubt upon its validity in view of the prior

[35] Manning *v.* Cape Ann Isinglass Co., 108 U. S. 462, 465; Twyman *v.* Radiant Glass Co., *supra*; Paraffine Co. *v.* Everlast, *supra*, pp. 338, 339.

[36] Compare Hall *v.* Macneale, 107 U. S. 90, 96-97.

art. This is, of course, upon the assumption that it is not for the same invention as '150. The whole matter however is rather academic since '149 is coincident in duration with '150, and the defendant's process infringes the somewhat more precise, if not narrower, claims of '150.

"This patent is therefore held valid and infringed."

The holding was assigned as error in the Circuit Court of Appeals and is specified as error in the petition for certiorari.

In view of our decision as to 1,584,150 and of the basis of the decision below respecting 1,584,149, we think the petitioner is entitled to a reexamination of the questions of the validity and infringement of the latter.

The decree of the Circuit Court of Appeals must be reversed and the cause remanded to the District Court with directions to dismiss the bill as to Nos. 1,584,150 and 1,896,020, and to proceed, in the light of the ~~invalidity of~~ those patents, to determine whether 1,584,149 is valid and infringed.

It is so ordered.

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